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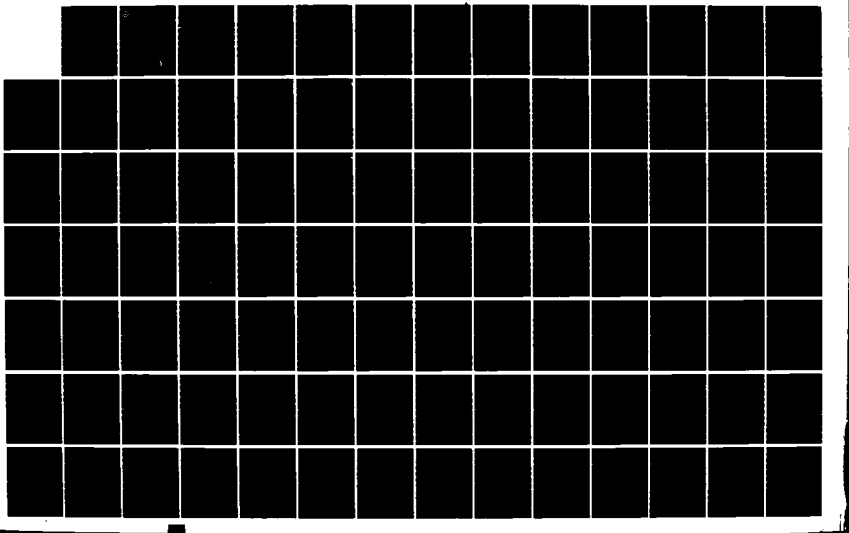

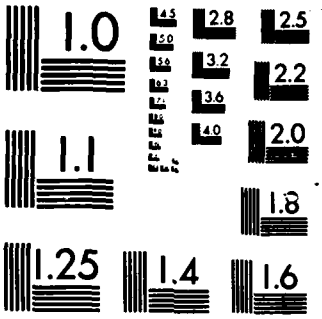

DEFENSE COMMUNICATIONS AGENCY
WASHINGTON, D. C. 20305

DCA CIRCULAR 600-60-1
Change 2

23 September 1985

ANALYSIS

Defense Communications Agency
Cost and Planning Factors Manual

1. DCA Circular 600-60-1, 4 March 1983, is changed as follows:

REMOVE PAGES	INSERT PAGES
vii through xxx	vii through xxx
1-1 through 1-4	1-1 through 1-4
1-7 through 1-15	1-7 through 1-16
2-1 through 2-12	2-1 through 2-20
8-1	8-1 through 8-18
11-1 through 11-4	11-1 through 11-4
11-7, 11-8	11-7, 11-8
20-1 through 20-3	20-1 through 20-4
21-1 through 21-8	21-1 through 21-9
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24-1 through 24-4	24-1 through 24-4
24-19 through 24-22	24-19 through 24-22
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42-1 through 42-12	42-1 through 42-12
I-1 through I-9	I-1 through I-9

The changed portions are indicated by number signs (#) in the left margin of the new pages.

OPR: H690
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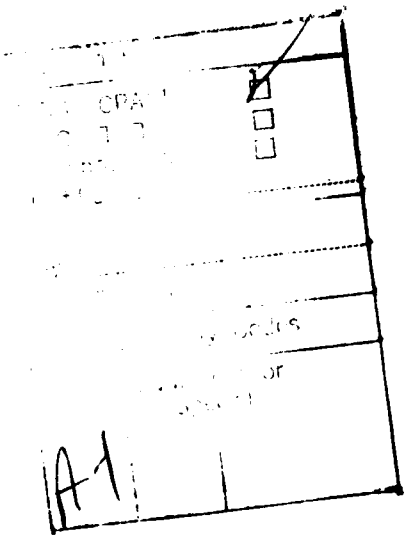
2. When the above action has been completed, this change may be filed with the basic publication.

FOR THE DIRECTOR:

1 Enclosure a/s

DARLENE K. BREWER
Colonel, USAF
Chief of Staff



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SECTION E. LEASED COMMUNICATIONS COSTS AND SUBSCRIBER RATES

ILLUSTRATIONS (CON.)

DEFINITIONS AND GLOSSARY OF TERMS

Antenna Systems (Line of Sight). Parabolic reflectors and feed horns (usually quoted as one item), radomes, antenna mounts, and passive reflectors, if used.

Assembler. Employee whose primary duty is to convert individual components to make an assembly or subassembly. Works with preformed jigs, harnesses, and fixtures. Manual dexterity is required.

Associate Engineer. An action officer working under supervision in a professional capacity but making only minor decisions which are subject to review.

Commercial Documentation. Documentation based upon the DoD Authorized Data List (referred to as TD-3) required to manage and develop a capability to support equipment of a commercial nature, with contractor assistance in some cases. Verified contractor publications overhaul, etc., are included.

Computer Programers I, II, and III. Computer Programer III is a fully qualified journeyman performing the same functions as the Senior Computer Programer, but with no supervisory responsibilities. Computer Programers I and II are of a less skilled classification and are closely supervised.

Computer Systems Specialist. Technically trained employee specializing in the selection and integration of computer components to match the operating characteristics and capabilities of the operating system.

Constant Dollars. Costs expressed in terms of the value of a dollar in a specified base year.

Cost-of-Living Allowance. This allowance is made to compensate for the difference existing between the adjusted annual pay rate and the prevailing standard of living in a particular geographical area.

Current Year Dollars. (Also "then year" or "inflated dollars.") Costs expressed in actual amounts, including any amounts due to economic price level changes.

Degree-day. A unit of heat measurement equal to 1 degree of variation below a standard temperature of the average temperature of 1 day.

Development Tests. The test planning and use of prototype equipment to acquire engineering data and confirm engineering hypotheses.

Direct-Hire Foreign National Personnel. Non-U.S. citizen personnel employed by the U.S. Forces overseas. Pay rates determined by the U.S. Forces are

usually aligned to the prevailing rates paid for comparable work in the particular geographical location. The U.S. Forces overseas are directly responsible for administration of management functions for direct hire foreign national personnel; and indirectly responsible for indirect hire foreign nationals.

Discounting. An adjustment to cash flow to account for the cost of capital. See "present value."

Diversity. The method of transmission or reception whereby, to reduce the effects of fading, a single received information signal is derived from a combination of, or selections from, signals containing the same information (MIL-STD-188-100).

Diversity, Frequency. The method of transmission or reception wherein the same information signal is transmitted and received simultaneously on two or more frequencies (MIL-STD-188-100).

Diversity, Space. The method of transmission or reception which employs antennas having spatial separations (MIL-STD-188-100).

Economic Life. The period of time during which a system or equipment will perform its function at a cost equal to or less than the cost of any alternative method of operation, or as long as the benefits received are greater than the cost. Economic life is sometimes equated to useful life, but may differ substantially from physical life.

Electronic Module. A combination of components contained in one or more packages and so arranged that they are common to one mounting which receives and delivers electrons to provide a complete function or functions for the subsystem in which they operate. Also, an interchangeable plug-in item containing components.

Electronics Technician. Technical personnel involved in the installation and maintenance of electronics equipment. Senior technicians are fully qualified journeymen. Junior technicians have fewer skills and experience and more limited capabilities.

Engineering Data. Drawings, associated lists, specifications, and other documentation pertaining to systems, subsystems, component engineering, and testing.

Engineering Manager. An engineer with responsibility for planning, organizing, and directing engineering activities of outstanding importance usually in a production facility.

Engineering Specialist. A highly skilled engineer engaged in the solution of engineering problems and manufacturing techniques of great difficulty but confined to a specialized area of expertise.

Fabrication Plant Employee. Employee with skills to assemble structural components who works from blueprints, drawings, or sketches. An accomplished metalsmith and welder.

Feed System. Waveguide (transmission line), circulators, dehydrators and pressure systems, and the mounting hardware to carry signals between the radio set and the antennas.

Frequency Division Multiplex (FDM). A method of deriving two or more simultaneous, continuous channels from a transmission medium connecting two points by assigning separate portions of the available frequency spectrum to each of the individual channels.

Full Support Documentation. That documentation based upon TD-3 required to manage and develop complete in-house Government capability for life-cycle support. Documentation at this level is normally procured for large quantities of equipment with a life cycle longer than 5 years.

Hazardous Duty. Duty performed under circumstances in which an accident could result in serious injury or death, such as duty performed on an open structure where adverse conditions exist such as darkness, lightning, steady rain, or high wind velocity.

Indirect-Hire Foreign National Personnel. Non-U.S. citizen personnel, employed by the host government to accommodate needs of U.S. Forces for local national personnel. Responsibilities for administrative management functions are assumed by the host government, and wages are usually aligned with those paid for comparable work in the particular geographical location.

Industrial Engineer. A person responsible for planning manufacturing processes to optimize efficiency. Is responsible for human factors and safety aspects of manufacturing.

Installation Supervisor. May be either an engineer or highly skilled technician who supervises technicians in the installation of components in their operating environment.

Life Cycle Costs (LCC). The total cost to the Government for a system over its full life, including the cost of development, procurement, operation, support, and where applicable, disposal.

Line of Sight (LOS). A direct propagation path that does not go below the radio horizon. Distance to the horizon from an elevated point. This path is affected by atmospheric refraction.

Management Data. Data necessary for configuration management, cost, schedule, and contractual data management and other program management.

Model Shop Wireman. Technician engaged in using schematics to wire components without the benefit of premanufactured harnesses. Often designs special jigs and fixtures.

Node. (Also called Junction Point, Branch Point, or Vertex.) Terminal of any branch of a network or terminal common to two or more branches of a network (MIL-STD-188-100).

Operating Life. That period of time when, through maintenance and repair, a system or equipment will continue to operate. Cost is not a consideration in its determination.

Operational Evaluation. Production hardware evaluation by the ultimate using command, demonstrating the system performance and tactical use under operational conditions.

Patch and Test. The function of quality control, equipment or channel substitution for maintenance or isolation of communications faults, accomplished under the technical supervision of a designated technical control facility.

Phase Shift Keying (PSK). A method of modulation used for digital transmission in which the phase of the carrier is discretely varied in relation to a reference phase, or phase of the previous signal element, in accordance with the data to be transmitted.

Physical Hardship Duty. A duty which of itself may not be hazardous but which causes extreme physical discomfort or distress and is not adequately alleviated by protective or mechanical devices. Examples are duty requiring exposure to extreme temperatures for a long period of time; duty performed in cramped conditions; duty involving exposure to fumes, dust, and noise, which causes nausea, skin, eye, ear, or nose irritation.

Piece Parts. Those bits and pieces; i.e., nuts, bolts, transistors, resistors, etc., required for maintenance and repair of equipment or modules.

Post Differentials in Foreign Areas. The payment of post differentials provides a method of enhancing recruitment or incentive pay for a geographical area which may be remote or in a hazardous location.

Present Value. The present worth of past or future benefits and costs determined by multiplying each year's actual or expected cost by its discount factor and summed over all years of the planning period to make alternative programs and actions comparable regardless of time differences in the money flows.

Principal Engineer. A consultant and an outstanding contributor to the solution of complex problems; their solution often extends the existing state of the art.

Project Engineer. A supervisory communications engineer responsible for all engineering efforts required of the project.

Project Manager/Senior Official. An employee who by demonstrating excellence in technical and managerial positions has assumed a position of leadership within the company and is assigned to direct projects of major importance to the customer and company.

Pulse Code Modulation (PCM). A modulation process for the conversion of a waveform from analog to digital form by quantizing the analog information into a series of pulse codes.

Radio Set. Equipment used to transmit and receive the R.F. signals, including the transmitters, receivers, power supplies, and combiners.

Repeater Station, Radio. An intermediate station in a microwave system arranged to receive a signal from a distant station, and amplify and retransmit the signal to another distant station. The repeater usually performs this function in both directions simultaneously.

Replacement Factor. The estimated percentage of equipment or repair parts in use that will require replacement during a given period due to the equipment wearing out beyond repair, enemy action, abandonment, pilferage, and other causes except major catastrophes.

Reprocurement Documentation. That documentation required to assure that equipment procured on a "more of the same" basis is identical to equipment previously procured and satisfactorily supported.

Residual Value. The value assigned to a system at a given time prior to the end of its economic life.

Senior Computer Programer. Technically trained employee having the knowledge required to translate instructions into machine-understandable language. Capable of writing complex programs and supervising and instructing those with less developed skills.

Senior Engineer. Often an action officer who may work on problems with little or no historical precedents and who may supervise less experienced technical and support personnel. Has no line supervisory responsibilities.

Senior Supervisory Systems Analyst. A manager skilled in directing analysis of problems so as to design a computer program for use in this resolution.

Support Documentation. Recorded data and information necessary to operate, maintain, and manage.

Systems Analyst. Technically and scientifically trained employee with qualifications similar to those of a Senior Supervisory Systems Analyst but with no managerial or supervisory duties.

Systems Engineeer. An engineer with skills required to interface the individual subsystems of a communications system into an integrated whole. Must know different transmission media and modulation techniques.

Tailored Support Documentation. That documentation based upon TD-3 required to manage and develop limited Government in-house and contractor capability to support a limited number of equipment with a short useful life cycle. It can also include changes or improvement to documentation previously procured.

Technical Control. The functions of technical direction, coordination, technical supervision of transmission media and equipment, quality control, communications service restoral, and status reporting required to provide effective communications to the users. This includes direction of activities in any work area of the communications station containing distribution frames and associated jacks or switches through which equipment and facilities are patched or switched to provide the required transmission path. The work areas also include any test equipment or testing capability.

Technical Evaluation. The evaluation of performance characteristics of production (or near production) configured hardware, culminating in Government acceptance of contractual performance requirements.

Technical Orders and Manuals. Handbooks, technical manuals, technical orders, technical data sheets, and other like documentation required by DoD.

Technological Life. The period of time that the equipment will represent current technology. New technology may represent faster, more sophisticated systems; however, current technology may still adequately and economically meet the system requirements.

Terminal Value. The value of a system or equipment at the end of either the project life or the end of the economic life, whichever occurs first.

Test and Evaluation Support. All support elements necessary to operate and maintain systems and subsystems during testing and evaluation which are not consumed during a particular phase of testing; for example, reparable spares, repair parts, and contractor technical support not assigned to and costed within a particular phase of testing.

Test Facilities. Special test facilities required for performance of various developmental tests necessary for proof of design and reliability of the system or subsystem, such as white rooms, test chambers, etc.

Time Division Multiplex (TDM). Multiplex arrangement where several message channels share a single transmission facility, each having its own time slot.

Tropical Differential. Additional pay applicable to the Panama Canal Zone that is paid to one member of a household who may be employed by the DoD in that location.

ABBREVIATIONS AND ACRONYMS

A&E	architectural & engineering
A/C	air-conditioning
Add.	additional
Adm.	administrative
ADP	automatic data processing
ADPE	automatic data processing equipment
^{o}F	degree(s) Fahrenheit
AFB	Air Force base
AFM	Air Force manual
AFSC	Air Force Systems Command
AMT	AUTODIN multimedia terminal
ARPANET	Advanced Research Projects Agency Network
ASCII	American Standard Code for Information Interexchange
ASIF	Airlift Service Industrial Fund
ASR	automatic send/receive
AT&T	American Telephone and Telegraph
AUTODIN	Automatic Digital Network
AUTOSEVOCOM	Automatic Secure Voice Communications
AUTOVON	Automatic Voice Network
Aux.	auxiliary
b/s	bits per second
B/T	berth term (shipping)
BD	baud(s)
Bldgs	buildings
BLS	Bureau of Labor & Statistics
BOQ	bachelor officer's quarters
Btu	British thermal units
C/M	card(s) per minute
CADIN	Continental Air Defense Integration North
CAU	CRYPTO ancillary unit
CCT	computer communications terminal
CCTC	Command and Control Technical Center
CCU	common control unit
CDRL	Contract Data Requirements List
CER	Cost-Estimating Relationship
Ch.	chapter(s)
Civ.	civilian
Ckts.	circuits
Comm.	communication(s)
COMSATCOM	Commercial Satellite Communications System
CON.	continued
Condt'd	conditioned
CONUS	contiguous United States
COTR	contracting officer's technical representative
CSIF	Communications Services Industrial Fund
CSM	circuit switch module
CTL	contingent termination liability
Ctrl.	control

cu	cubic (measure of volume)
DA	Department of Army
DCA	Defense Communications Agency
DCAC	DCA circular
DCAI	DCA instruction
DCAOC	Defense Communications Agency Operations Center
DCEC	Defense Communications Engineering Center
DCP	Decision concept paper
DCS	Defense Communications System
DCT	data communications terminal
DDN	Defense Data Network
DEB	Digital European Backbone
DECCO	Defense Commercial Communications Office
Demod.	demodulation
DFSC	Defense Fuel Supply Center
diam.	diameter
DLC	direct labor costs
DLT	data line terminal
DoD	Department of Defense
DSCS	Defense Satellite Communications System
DSM	device switching module
DSTE	digital subscriber terminal equipment
EAM	electric accounting machines
EHF	extremely high frequency
Enl.	enlisted
Equip.	equipment
F/I	free in (Shipping)
FCC	Federal Communications Commission
FCRC	Federal contract research center
FDM	frequency division multiplex
FDX	full duplex
Fig.	figure
FIO	free in (shipping), free out
FOIA	Freedom of Information Act
ft	foot (feet)
ft^2	square foot (feet)
ft^3	cubic foot (feet)
ft^3/min	cubic foot (feet) per minute
FY	fiscal year
FYDP	Five Year Defense Program
FYP	Five Year Program
G&A	general & administrative
gal	gallon(s)
GFM	Government furnished material
GHz	Gigahertz - one thousand million Hertz
GS	General Service (civilian employee)
GSA	General Services Administration
H.T.	heavy terminal
HDBK	handbook
HDX	half duplex

HEMP	high altitude electromagnetic pulse
HF	high frequency
hr	hours(s)
HSCT	high speed compound terminal
I/O	input/output
IF	intermediate frequency - usually 70 megahertz
ILC	indirect labor costs
IMP	interface message processor
Incl.	includes
Init.	initial
Instl.	installation
IRC	international record carrier
Is.	island(s)
ITA	International Telegraph Association
IUS	Interim upper stage
JTR	Joint Travel Regulations
K	one thousand (1×10^3)
Kb/s	Kilo (thousand) bits per second
kVA	kilovoltampere
kW	kilowatt - one thousand watts
kw	kilowatt
kWh	kilowatt hours
L.T.	light terminal
Lat.	latitude
lb	pound(s)
lbf/ft^2	pounds of force per square foot
LCC	life cycle costs
L.ft.	Linear foot
lin.	linear
LOS	line-of-sight
LSCT	low-speed compound terminal
LT	long ton (shipping weight of 2,240 pounds)
M	one million (1×10^6)
M.T.	medium terminal
MAC	Military Airlift Command
MAG	magnetic
Maint.	maintenance
MCA	maximum calling area
MCP	military construction price
MEP	Management Engineering Plan
Mgmt.	management
Mi.	mile
Mil.	military
MINET	Movements Information Network
Misc.	miscellaneous
MLPP	multilevel precedence preemption
Mod.	modulation
MODEM	modulator-demodulator
MOS	military occupational specialty
MSTS	Military Sea Transport Service
MT	measured ton

MTMC	Military Traffic Management Command
MUX	multiplex(or)
MW	microwave
N.	north
N/R	not required
NARS	National Archives & Records Service
NAV	Naval, Department of the Navy
NAV FAC P	naval facilities pamphlet
NEC	Navy Enlisted Classification
No.	number
O&M	operations and maintenance appropriation
O/S	overseas
OCS	Officer Candidate School
ODC	other direct charges
Off.	officers
OJT	on-the-job training
OMB	Office of Management & Budget
OPR	office of primary responsibility
OSD	Office, Secretary of Defense
OTP	Office of Telecommunications Policy
OW	orderwire
P&T	patch & test
Pam.	pamphlet
Para.	paragraph
PBX	private branch exchange
PCAM	punch card accounting machine
PCB	printed circuit board
PCM	pulse code modulation
PCS	permament change of station
PEC	program element code
Pers.	personnel
PNB	precise-no-break
POL	petroleum, oil, and lubricant
POV	privately owned vehicle
PPM	principal period maintenance
PSK	pulse shift keying
PTE	peculiar test equipment
PTT	post telephone and telegraph
Pwr.	power
Qtrs.	quarters
R&D	research and development
Recur.	recurring
r/m	revolutions per minute
RDT&E	research, development, test, and evaluation
Refl.	reflector
Reimb.	reimbursements
RF	radio frequency
Sat.	satellite
SECORD	secure voice cord board
SG	supergroup

SHF	super high frequency
SOW	statement of work
Spec.	specialist
Spt.	support
sq	square (measure of area)
ST	short ton (2,000 pound avoirdupois)
Sta.	station
Str.	strand
T	ton
TCF	technical control facility
TD-3	DoD Authorized Data List
TDM	time division multiplex
TDY	temporary duty
Tech.	technical or technician
TIP	terminal interface processor
TM	training manual
TO	technical order
TOA	total obligation authority
TSM	technical staff month
U.S.	United States
UHF	ultra high frequency
UPS	uninterruptible power supply
VDC	volts direct current
VF	voice frequency
VFCT	voice frequency carrier telegraph
VHF	very high frequency
w/m	words per minute
W/O	without
WB	Wage Board (civilian employee)
WAWS	Washington Area Wideband Service
WIN	WWMCCS Intercomputer Network
WWMCCS	Worldwide Military Command and Control System
xmtr	transmitter
yd	yard
yd^2	square yard(s)
yd^3	cubic yard(s)

SECTION A. COST-ESTIMATING PROCEDURES

CHAPTER 1. LOS MICROWAVE SYSTEMS

1. Introduction.

a. Line-of-sight (LOS) microwave systems normally use the frequency spectrum from 2 to 12 gigahertz (GHz). The LOS path lengths range from 1 to 100 miles depending upon propagation, terrain, frequency, and tower height, among other engineering considerations. The average system consists of path lengths of approximately 30 miles. The total microwave system consists of terminals, relays, and the normal support functions required for any communications system, such as technical control, multiplex, utilities, land, and buildings.

b. LOS microwave transmission is usually dual diversity, using either frequency, space, or polarization diversity. The transmission system will generally contain dual receive and transmit equipment at all locations for use as either frequency diversity systems or "hot standby" systems for redundancy.

c. Two techniques may be employed for the transmission and multiplexing of communications circuits. DCS uses frequency modulation transmission and frequency division multiplex (FDM) also called "analog systems." Currently DCS uses digital transmission and time division multiplex (TDM), referred to as "digital systems." Both analog and digital systems use the same antennas, waveguide, towers, power, etc., with the basic equipment differences being in the radios, the multiplex, and the peculiar test equipment. The costing example shown in this chapter will cover "digital systems" through the substitution of costs for digital radios (chapter 10) and TDM (chapter 11) for the comparable analog radios and multiplex.

d. LOS microwave stations contain such equipment as radio sets, towers, antennas, feed systems, power supplies, orderwire, alarm systems, patch and test facilities, distribution frames, and multiplexers.

2. Project Description. Proposed hypothetical subsystem project plan X-7X requires the installation of a fixed LOS microwave system in Germany. The overall subsystem description is presented in table 1-1, and the configuration is portrayed in figure 1-1. The new system is designed to operate through a nodal station (part of the DCS). The area is in the temperate zone with moderate environmental conditions. There are no unduly restrictive local conditions or requirements that will affect the system planning. The system will contain three terminal or end locations (see figure 1-3), two relays (see figure 1-4), and a nodal station (figure 1-5). The system is to be operational in 2 years, and the schedule calls for terminal number 1, relay number 1, and the equipment for this link

at the nodal point to be under contract by fiscal year 1 of the subsystem project plan. The remainder of the equipment and buildings and the training are to be contracted for and the system turned over at the end of fiscal year 2. Operations will begin with fiscal year 3. All system equipment (see figure 1-2) is envisioned as being new to the Government and requires full support documentation with the exception of the microwave radio, multiplex, power, and test equipment which should be considered reprocurement.

3. Project Cost Estimate. Tables 1-2 and 1-3 present completed cost estimate worksheets, and table 1-4 presents a time-phased funding schedule for this example system.

4. Cost Model. To be published later.

#

TABLE 1-1. SUBSYSTEM DESCRIPTION-LOS MICROWAVE SYSTEM

Equipment and Facilities	Terminal 1	Terminal 2	Terminal 3	Relay 1	Relay 2	Nodal Point
Voice Frequency Channel	60	60	60	0	0	180
Radio - AN/FRC-173(U) 8 GHz FD	1	1	1	2	2	3
Antenna - Dual 8' w/Radome	1	1	1	2	2	3
Reflectors - 4' x 6'			1			1
Towers	1@	1@	1@	1@	1@	1@
(guyed) (ft.)	100	100	100	100	100	200
Power Availability						
Primary	Yes	Yes	Yes	No	No	Yes
Auxiliary	No	No	No	No	No	No
Building Availability	No	No	No	No	No	No
Fence Requirement	No	No	No	Yes	Yes	No
Land Requirement (Acre)	No	No	No	1/2	1/2	No
Access Road Required (mi.)	No	No	No	1/2	1/2	No
Manpower Required						
Officer in Charge				Unmanned		1
Shift Supervisors (Enlisted)	2	2	2			2
Radio						
Enlisted	3	3	3			5
Civilian	1	1	1			1
MUX						
Enlisted	2	2	2			4
Civilian	1	1	1			1
Tech Control (Enlisted)						5
Power Tech (Enlisted)						2
TOTAL	9	9	9	0	0	21

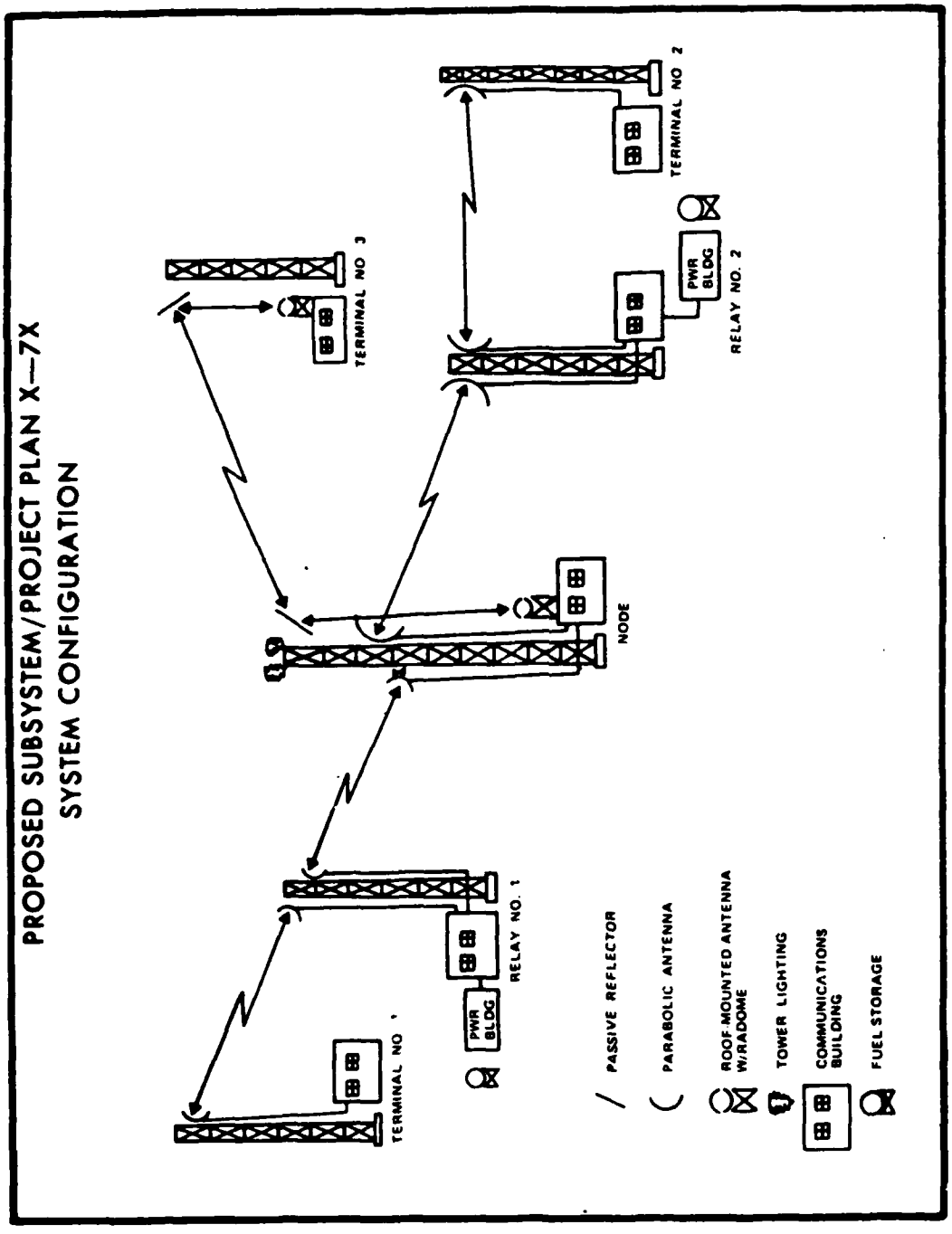

FIGURE 1-1. LOS MICROWAVE SYSTEM - EXAMPLE SYSTEM CONFIGURATION

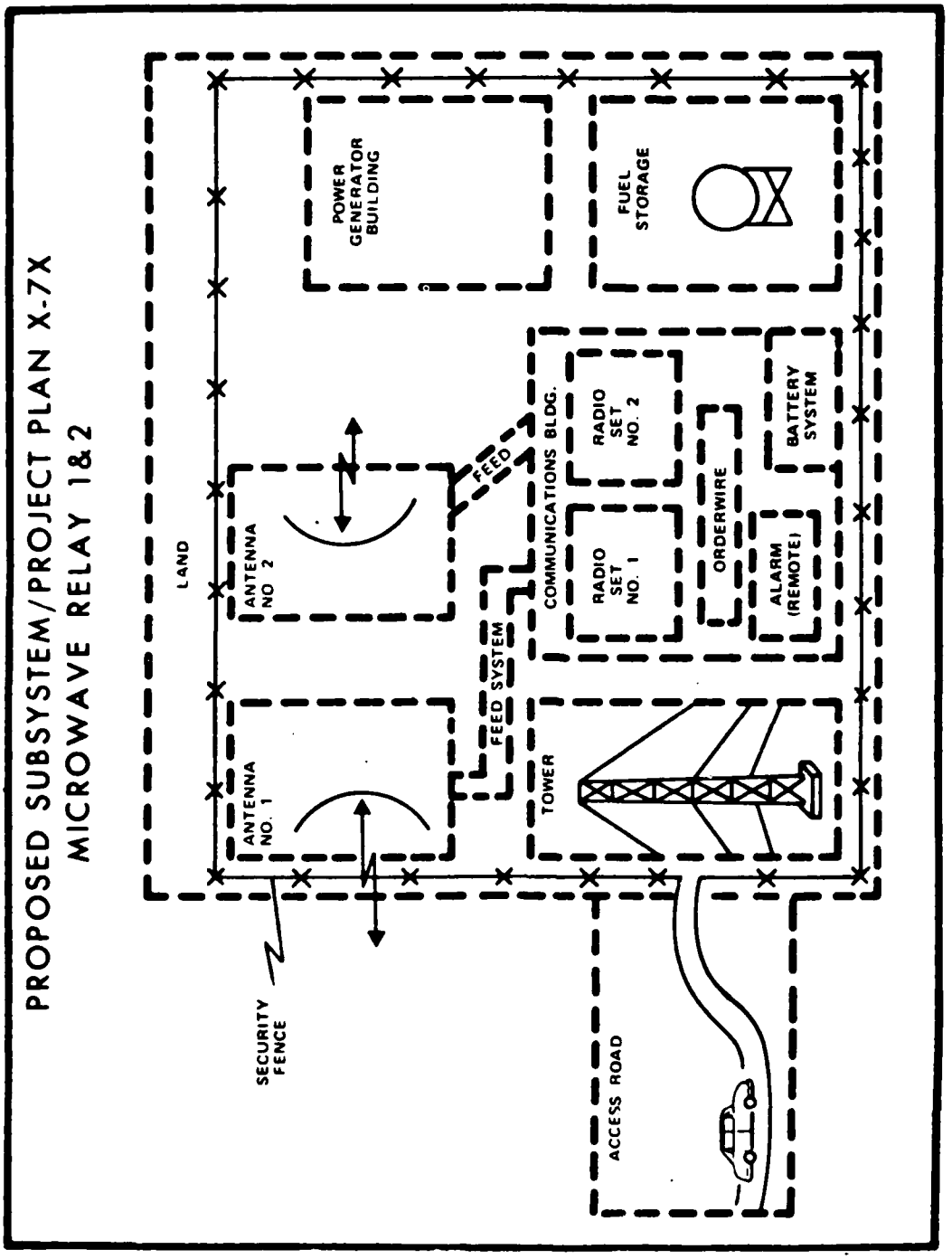

FIGURE 1-4. LOS RELAY LAYOUT - BUILDING BLOCK CONCEPT

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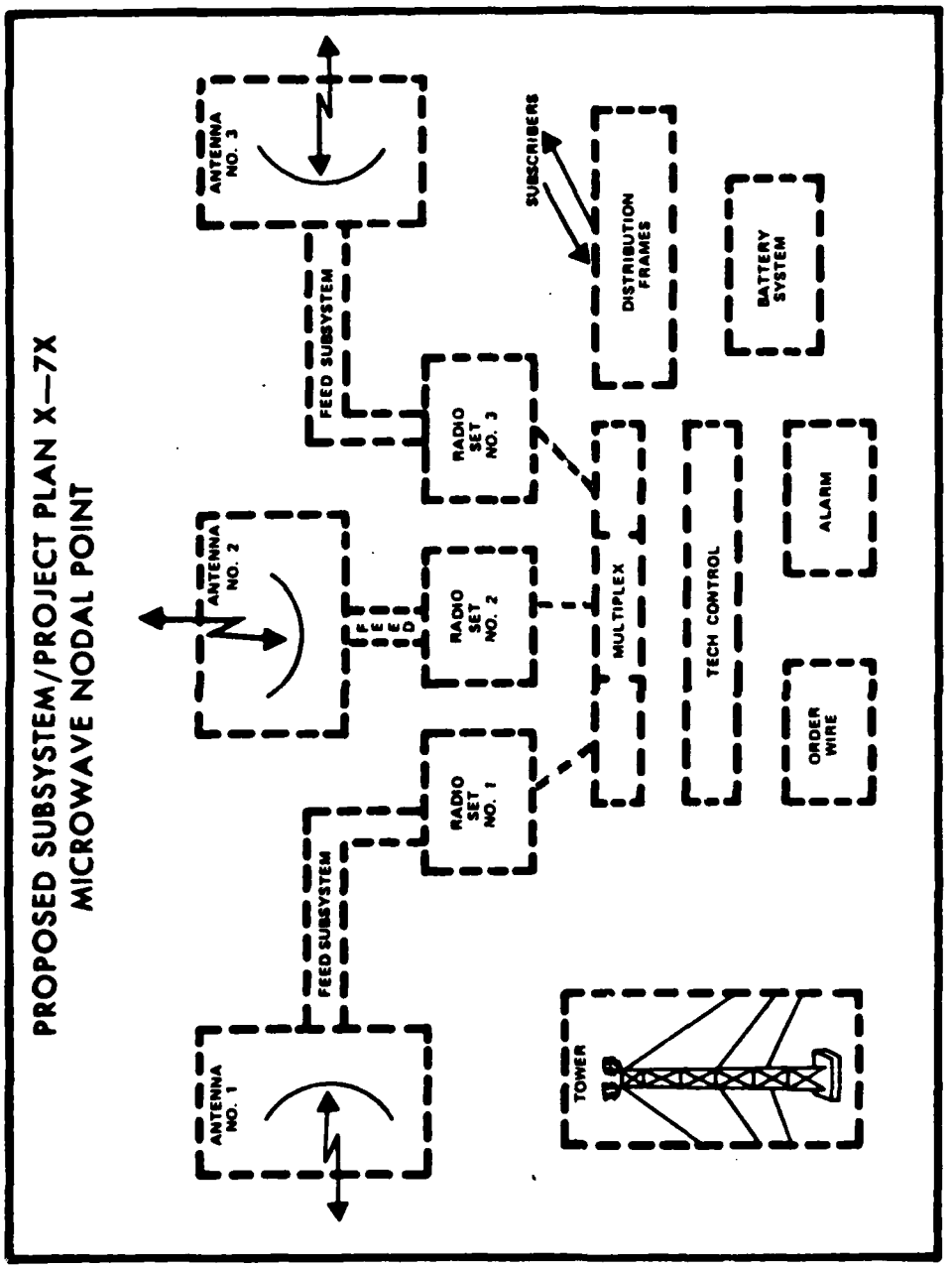

FIGURE 1-5. LOS NODE LAYOUT - BUILDING BLOCK CONCEPT

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TABLE 1-2. ACQUISITION COST - PROPOSED SUBSYSTEM/PROJECT PLAN X-7X
LOS MICROWAVE SYSTEM

Cost Estimate Structure	Reference Chap.	Table	Value/Computation	Index[1]	Total ($000)
Communication Prime Mission Equipment					
LOS Microwave Equip.	10				
Radio Set (DRAMA)		1	10 @ $37,158	1.75	$650.3
Antenna System					
Dual - 8' w/Radome		2	10 @ $8,550	1.24	106.0
Reflector-4' x 6'		5	2 @ $710	1.75	2.5
Feed System		3	10 @ $1,643	1.75	28.8
Tower (Guyed)		4	5 100' @ $13,400; 1 200' @ $26,000	1.75	93.0
Multiplexer	11	1			
Level 1-AN/FCC-98(V)			18 @ $7,600	1.75	239.4
Voice Card-Level 1			360 @ $285	1.75	179.6
Level 2-AN/FCC-99			6 @ $11,319	1.75	118.8
Voice Card Level 2			18 @ $640	1.75	20.2
Control System Equip.	13				
Tech. Cont., Patch and Test[2]		1	3 Terminal @ $100,000/ Term., $200,000/Node	1.00	500.0
Orderwire/Intercom		4	4 Type A @ $10,700	2.50	107.0
Alarm System		5	4 Type A @ $370, 1 Type II @ $2,900, 5 Type I @ $1,900	2.50	34.7

[1] To reflect base-year costs at current price levels--chapter 38, table 1.
[2] Estimate provided by Code 690.

TABLE 1-2. ACQUISITION COST - PROPOSED SUBSYSTEM/PROJECT PLAN X-7X
LOS MICROWAVE SYSTEM (CON.)

Cost Estimate Structure	Reference Chap.	Table	Value/Computation	Index	Total ($000)
Auxiliary Equipment	14				
Primary Power		2	3 x 12.5 KW x 2 Relays x $1,500	1.00	$112.5
Auxiliary Power		2	6 [30,900 (1.25)$^{.4}$ + 1,424]	1.00	210.6
Subtotal-Comm. Equip.					$2,403.4
Integration and Assembly	15		5% of Comm. Equip. ($2403.4)	N/A	120.2
Contractor Training	16	1	2 weeks' course prep. @ $23K	1.89	43.5
			5 two-week classes @ $30K	1.89	56.7
Test and Support Equip.	17				
Test and Comm. Equip.		1	10% of $2,403.4	N/A	240.3
Peculiar Spt. Equip.			5% of $2,403.4	N/A	120.2
System Test and Eval.	18		5% of $2,403.4	N/A	120.2
System Project Mgmt.	19				
System Engineering		1			
Contractor			10% of $2,403.4	N/A	240.3
FCRC			5 Man-years @ $110,400/ Man-year	1.06	585.1
Project Management			10% of $2,403.4	N/A	240.3
Data	20	1	Reprocurement-Tailored Spt.		
			Radio $37,158	1.75	
			Antenna 9,260	1.24	
			Tower 39,400	1.75	
			Feed 1,643	1.75	
			MUX 19,844	1.75	
			TCF and PTF 300,000	1.00	
			Orderwire 11,070	2.50	
			Alarm 4,800	2.50	
			Power 72,605	1.00	
			Test Equip. 240,350	1.00	
			.5 X $839,800		419.9

TABLE 1-2. ACQUISITION COST - PROPOSED SUBSYSTEM/PROJECT PLAN X-7X
LOS MICROWAVE SYSTEM (CON.)

Cost Estimate Structure	Reference Chap.	Table	Value/Computation		Index	Total ($000)
			New Procurement-Tailored Peculiar Support ($120.2 / 6) x 7		N/A	$140.2
Operational Site Activation	21					
Contractor Tech. Spt.		1	7% of $2,403.4		N/A	168.2
Site Construction						
Land Acquisition		2	two 1/2-Acre lots @ $3,000/Acre	$3.0		
Site Surv./Prep.		2	4,840 x $3.95 + $2,520 + $300	21.9		
Buildings/Shelters		4	6 Comm. Bldg. @	1,146.6		
Fences		2	$191,100 2 x 625 L.ft. x $14.00/L.ft.	17.5		
Access Roads		2	2 x 1/2 Mi. long x 4 yd wide x 8" deep @ $31.50/yd^2	221.8		
Fuel Storage Facil.		3	two 1,500-Gallon Tanks 2 x 2.016 x (1.5 + .359)	7.5		
Construction Index	36	3	Area Factor 1.5 x	1,418.3	1.00	2,127.5
Assembly, Instal., and Checkout Onsite	25	5	20% of $2,403.4		N/A	480.7
Initial Spares & Repair Parts	22	1				
Radios			650.3 x .35 = $227.6			
Antenna System			230.3 x .10 = 23.0			
MUX			558.0 x .25 = 139.5			
Other			964.9 x .20 = 193.0			
Peculiar Spt. Equip.			120.2 x .20 = 24.0			
Total Spare Parts						607.1
Transportation	24	8	9.1% x (Comm. Equip. + Test & Support Equip. + Spares .091 (2403.4 + 240.3 + 120.2 + 607.1)			306.8
GRAND TOTAL ACQUISITION COST						$8,420.6

TABLE 1-3. ANNUAL OPERATING COST - PROPOSED SUBSYSTEM/PROJECT PLAN X-7X
LOS MICROWAVE SYSTEM

Cost Estimate Structure	Reference Chap.	Table	Value/Computation	Index	Total ($000)
Military Personnel -					
Pay and Allowances	23				
Officers		1	1 O-3 @ $37,535	1.055	$ 39.6
Enlisted		1	39 E-5 @ $18,746	1.055	771.3
Operations and Maint.	24				
Civ. Personnel - U.S.		1	8 GS-11 @ $32,904	1.029	270.9
TDY-Per Diem		6	40 days @ $50/day	1.029	2.1
TDY-Transportation		6	4 MAC trips @ $400	1.049	1.7
Civilian PCS		7	8 @ $1,770	1.77	25.1
Transp. of Things		8	9.1% of Operations & Maintenance Materials (82.9 + 193.5)	1.00	25.2
Utilities and POL		13	11 K Gals. Fuel @ $1.03/Gal. x 2 relays	1.00	22.7
Building Maint.		13	.05 x $2,127.5 (site construction)	1.00	106.4
Supplies and Equip.		13	.03 x (Comm. Equip. + Test & Supt. Equip.) .03 x $2,764.1	1.00	82.9
Misc. Support		22	.003 x $2,764.1	1.00	8.3
Recurring Investment	25				
Replacement Spares			.07 x $2,764.1	1.00	193.5
Operating Support	26				
Base Operations		1	40 @ $1,400	1.24	69.4
Depot Maintenance		3	.005 x $2,764.1	1.00	13.8
Replacement Training		5	40 @ $20,196	1.09	880.5
Hospitals		6	40 @ $465	1.24	23.1
PCS Travel		7	40 @ $4,540	1.09	197.9
TOTAL ANNUAL OPERATING COSTS					$2,734.4

TABLE 1-4. TIME-PHASED COST ESTIMATE - PROPOSED PROJECT PLAN X-7X LOS MICROWAVE SYSTEM

Cost Element	FY 1	FY 2	FY 3 to 12	Total Cost ($000)
RDT&E	0	0	0	0
Investment				
Procurement				
Microwave Equip.	$ 352.3	$ 528.3		$ 880.6
Multiplex	223.2	334.8		558.0
Tech. Control and P&T	220.0	280.0		500.0
Orderwire	53.5	53.5		107.0
Alarm System	18.4	16.3		34.7
Electric Power	161.5	161.6		323.1
Integration and Assembly	51.7	68.5		120.2
Training	37.1	63.1		100.2
Test Equipment	155.1	205.4		360.5
System Test and Evaluation	51.7	68.5		120.2
System Engineering	470.4	355.0		825.4
Project Management	137.0	103.3		240.3
Data	239.8	320.3		560.1
Contractor Tech. Supt.	95.9	72.3		168.2
Assembly, Instl., and Checkout Onsite	206.7	274.0		480.7
Initial Spares and Repair Parts	261.1	346.0		607.1
Transportation	131.9	174.9		306.8
Military Construction				
Site Activation	1,212.5	915.0		2,127.5
Annual Operating				
Military Personnel			$ 810.9	8,109.0
Operations and Maint.			545.3	5,453.0
Recurring Investment			193.5	1,933.0
Operating Support			1,184.7	11,847.0
Total Including 10-Year System Cost	$4,079.8	$4,340.8	$2,734.4	$35,762.6

MICROWAVE SYSTEM/SITE COST ESTIMATE

Proposed Subsystem Project Plan # _____ Date _____
Project Name _____ Prepared by (Org.) _____

System Description _____

Operational Capabilities _____
Time Frame: Acquisition _____ Operations _____
Location _____

ACQUISITION COST

Cost Element Identification	Reference Chap.	Table	Value/ Computation	Total Cost ($000)
Prime Mission Equipment				
Communications Equipment	10			
Radio Equipment		1		
Antenna System		2		
Refl., Radome, Mounts		5		
Feed System		3		
Towers		4		
Multiplex	11	1		
Tech. Control and P&T Equip.	13	1		
Orderwire		4		
Alarm System		5		
Auxiliary Equipment				
Electric Power	14			
Primary Power		2		
Auxiliary Power		2		
Subtotal Prime Mission Equipment and Auxiliary Equipment				$
Integration and Assembly	15			
Contractor Training	16	1		
Test and Spt. Equip.	17			
Test and Common Equip.		1		
Peculiar Spt. Equip.		1		

FIGURE 1-6. COST ESTIMATE WORKSHEET - MICROWAVE SYSTEM/SITE

MICROWAVE SYSTEM/SITE COST ESTIMATE (CON.)

Cost Element Identification	Reference Chap.	Table	Value/ Computation	Total Cost ($000)
System Test and Evaluation	18			
System/Project Mgmt.	19			
System Engineering		1		
Contractor				
FCRC				
Project Management				
Data	20	1		
Operational/Site Activation	21			
Contractor Tech. Support		1		
Site Construction				
Land Acquisition		2		
Site Survey/Prep.		2		
Buildings, Shelters		4		
Foundations, Stands/Pads (Concrete, Misc.)		2		
Sewage Facilities				
Water Tanks		3		
(Construction Index)	36	1		
Assembly, Instl., and Checkout				
Onsite	25	5		
Init. Spares and Repair Parts	22	1		
Transportation	24	8		
Total Acquisition Cost				$

FIGURE 1-6. COST ESTIMATE WORKSHEET - MICROWAVE SYSTEM/SITE (CON.)

MICROWAVE SYSTEM/SITE COST ESTIMATE (CON.)

ANNUAL O&M COSTS

Cost Element Identification	Reference Chap.	Table	Value/ Computation	Total Cost ($000)
Military Personnel				
Pay and Allowances	23	1		
Operations and Maintenance	24			
Civilian Personnel -				
Pay and Allowances		1		
TDY		6		
Civilian PCS		7		
Transportation		8		
Utilities and POL -				
Electric Power		13		
Heat				
Contractor Employees				
Building Maintenance				
Supplies and Equipment				
Misc. Support		22		
Recurring Investment	25			
Operating Support	26			
Base Operations		1		
Depot Maintenance		3		
Replacement Training		5		
Hospitals		6		
PCS Travel		7		
Other Indirect Costs				
			Total Annual Operating Cost	$

FIGURE 1-6. COST ESTIMATE WORKSHEET - MICROWAVE SYSTEM/SITE (CON.)

CHAPTER 2. TROPOSPHERIC SCATTER SYSTEMS

1. Introduction.

a. Tropospheric Scatter Systems (tropo) are generally used for path lengths of 75 to 400 miles where terrain, geographic, or other factors dictate their use. Tropo normally uses that portion of the frequency spectrum from 700 MHz to 5 GHz. Tropo systems use a "bounce" technique, echoing the signals off the tropospheric layer of the atmosphere. The microwave signal, which leaves the earth at a very low takeoff angle, is forward scattered by the troposphere (with some of the signal passing through the atmosphere) and returns to the earth via diverse paths. Tropo, as opposed to line-of-sight systems, uses higher transmitter power output (up to 50 kW), larger antennas (up to 120 ft diameter), and has lower bandwidth availability (as low as 12 equivalent voice channels for analog and 24 for digital) dependent upon factors such as path length and propagation.

b. Tropo transmission is generally quadruple diversity, using space and frequency diversity. Some systems need only dual diversity, and there are systems using octuple diversity. There are some engineering "trade-offs" possible with tropo systems to meet the required propagation, such as higher transmitter power output with smaller antennas, multiple diversity, and combinations of the above. Transmission path requirements can be determined only by an engineering analysis of the individual paths involved.

c. There are two different techniques available for the transmission and multiplexing of communications circuits within the DCS, analog and digital. Analog systems utilize frequency modulation (FM) transmission and frequency division multiplex (FDM) while digital systems use pulse code modulation (PCM) and time division multiplex (TDM) with phase shift keying (PSK) transmission. Both analog and digital systems utilize similar antennas, waveguides, towers, and power, with the basic equipment differences being in the radios, the multiplex, the modem requirements, and the peculiar test and technical control equipment. Although the costing example used in this chapter reflects analog technology, the system may be readily converted to digital by either substituting digital radios and digital multiplex for their analog counterparts, or retaining the analog radio and adding digital modems and multiplex equipment.

d. Because of the economic and technical factors involved, only in certain situations would tropo be chosen over other methods of transmission. For example, tropo may be used in adverse terrain conditions or in a tactical situation utilizing mobile units. When sufficient engineering data exist to permit an analysis of the various transmission media for the same path, an engineering and economic analysis must be performed to determine the most suitable method. It should be noted that digital tropo transmission offers the same advantages over analog as digital transmission in LOS or satellite applications, namely, ease of encryption and improved performance quality in tandem-transmission-link applications.

e. Table 2-1 may be used for very rough planning estimates to approximate the required transmitter and antenna combinations.

TABLE 2-1. TROPO TRANSMISSION CAPABILITIES

Equivalent Voice Channels			Equipment Required	
Analog (FDM/FM)	Digital (64 Kb/s, PCM/TDM)	Path Length (in miles)	XMTR Output (in kW)	Antenna Diameter (in feet)
12	24 or 48	125	1	30
		325	10	60
		400	10	120
60	48 or 96	100	1	30
		175	1	120
		260	10	120
120	96 or 144	100	1	60
		225	10	120
240	144 or 192	100	10	120
		150	10	120

NOTE: Accurate transmission capabilities can be determined only by an analysis of the paths involved.

2. Project Description. The proposed hypothetical subsystem, project plan X-8X, requires the installation of a fixed tropo system for the Navy in the northern coastal area of Australia. (The overall subystem description is presented in table 2-2 and the configuration is portrayed in figure 2-1.) The new system will be designed to operate in conjunction with an existing DCS station. The area is in a hot dry zone in a subtropic area. The tropo transmission medium was chosen because of the terrain and the logistics problems involved in supporting a LOS microwave system. The system will consist of two links, three stations, and four terminals with all channels capable of being dropped at the intermediate station and reinserted by the technical controllers. Figure 2-2 presents a block diagram of the equipment

involved at all terminals while Figure 2-3 provides the building block layout of hypothetical tropo station #2. The system is to be fully operational in two years with Link 1 completed at the end of the first year. All system equipment is considered to be reprocurement rather than new equipment.

TABLE 2-2. SUBSYSTEM DESCRIPTION - ANALOG TROPO SYSTEM

Equipment and Facilities	Station Number 1	2	3
Transmitter Power Output	1kW	1kW	1kW
Frequency	1GHz	1GHz	1GHz
Antenna Size	60 ft	60 ft	60 ft
Analog			
VF Channel (equipped)	12	24	12
VF Channel (conditioned for data)	4	8	4
Digital			
VP Channel (64 Kb/s)	24	24	24
Data Channel (64Kb/s port on first level MUX)		(see Note)	
Adequate Prime Power Available	yes	yes	yes
Auxiliary Power Available	no	no	no
Buildings Available	no	no	no
Security Fence Required	no	no	no
Additional Land Required	no	no	no
Access Road Required	no	no	no
Manpower			
Officer in Charge	-	1	-
NCOIC	1	1	1
Tropo Repair Technician	10	15	10
Total	11	17	11

NOTE: User can apportion voice and data channels as desired.

3. Project Cost Estimate. Tables 2-3 and 2-4 present completed cost estimate worksheets for acquisition costs and annual operating costs for the sample subsystem project plan X-8X. A time-phased funding schedule for this project is outlined in Table 2-5. Blank worksheets for each of the above areas are provided to facilitate preparation of future cost estimates for tropo systems.

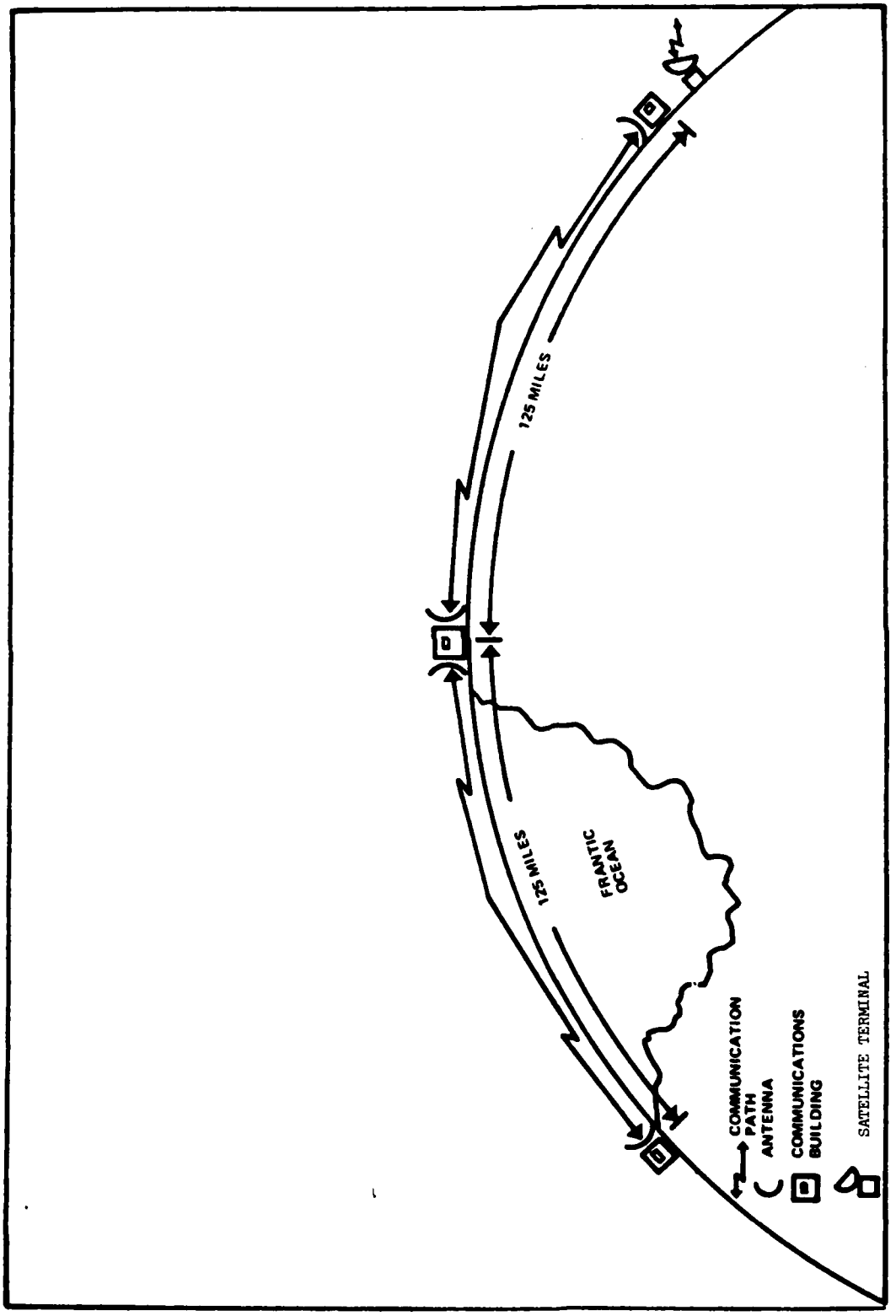

FIGURE 2-1. TROPOSPHERIC SCATTER SYSTEM - EXAMPLE CONFIGURATION

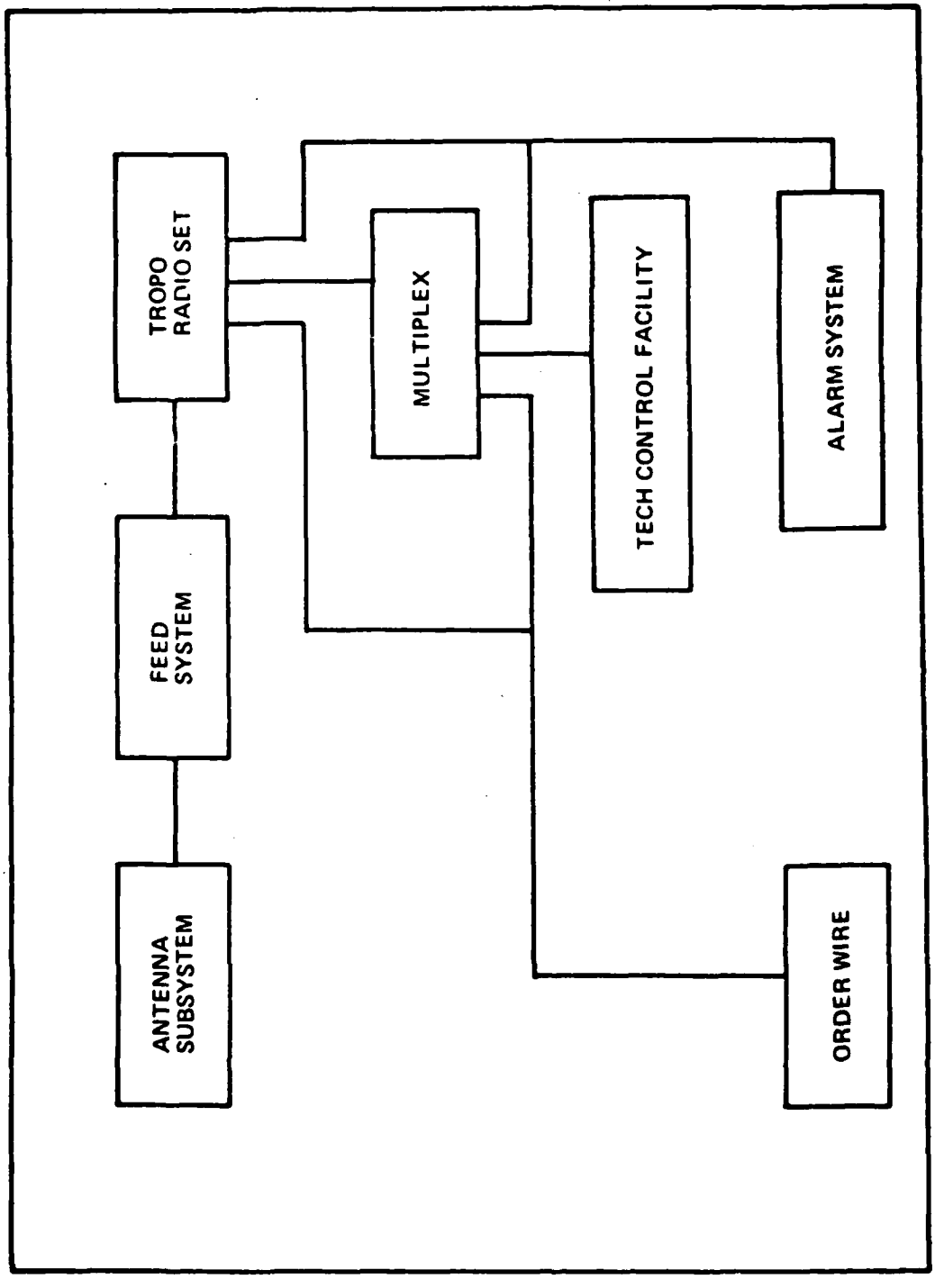

FIGURE 2-2. TROPO PRIME MISSION EQUIPMENT BUILDING BLOCK

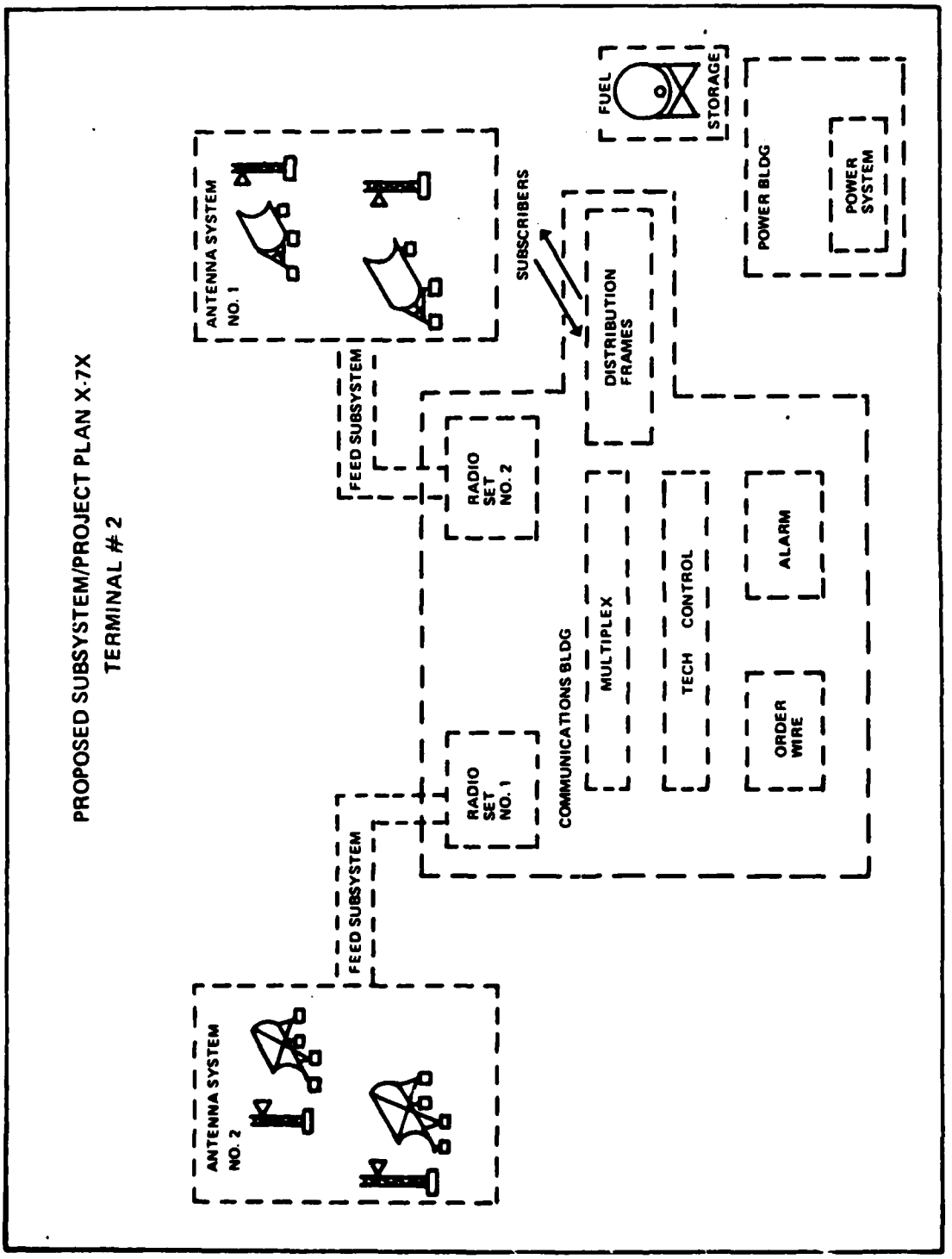

FIGURE 2-3. TROPO TERMINAL LAYOUT - BUILDING BLOCK CONCEPT

TABLE 2-3. ACQUISITION COST - SUBSYSTEM PROJECT PLAN X-8X
ANALOG TROPO SYSTEM 1GHz

Cost-Estimating Structure	Reference Ch.	Table	Value/Computations	Total ($000)
Comm. Prime Mission Equipment	10			
Tropo Radio Equip.	10			
Radio Set		6	1GHz, 1kW, 4 @ $243,000	$ 972.0
Antenna System		7	60 ft, 8 @ $37,200	297.6
Feed System		8	4 @ $11,345	45.4
Multiplex Equip.	11	3	12 Channel Set, 2 @ $46,700	93.4
			24 Channel Set, 1 @ $53,800	53.8
Control Systems Equip.	13			
Tech Control and Patch and Test		1	Terminating Ckts., 48 @ $175	8.4
		1	Data Condt'd Ckts., 16 @ $1,150	18.4
		2	Ckt. Control Equip., 3 @ $85,700	257.1
Orderwire/Intercom		4	Type A Configuration, 3 @ $10,700	32.1
Alarm System		5	Type A Common Unit, 3 @ $370	1.1
Auxiliary Equipment	14			
Electric Power				
Primary Power			Host-Provided	--
Auxiliary Power		2	100kW Diesel, 2 @ 100 Kw x $900	180.0
		2	200kW Diesel, 1 @ 200 Kw x $900	180.0
Subtotal (Comm. Equip.)				$2,139.3

NOTES: 1. For ease in following the above example, the costs obtained from the referenced tables have not been corrected for inflation to the project year. All estimated costs should be adjusted from the base year to the current or project year using table 38-1.

2. The example reflects an analog tropo system configuration. Future revisions of this document will contain cost data for digital subsystems.

TABLE 2-3. ACQUISITION COST - SUBSYSTEM PROJECT PLAN X-8X
ANALOG TROPO SYSTEM 1GHz (CON.)

Cost-Estimating Structure	Reference Ch.	Table	Value/Computations	Total ($000)
Integration and Assembly	15	Para. 2a	5% of Comm. Equip.	$107.0
Contractor Training	16		Course Preparation.	
		1	2-Week Class, 10	23.0
		1	Students, 4 @ $11,000	44.0
Test and Support Equip.	17			
Test and Common Equip.		1	10% of Comm. Equip. (4 sets)	213.9
Peculiar Support Equipment		1	5% of Comm. Equip. (4 sets)	107.0
System Test and Eval.	18	Para. 2a	5% of Comm. Equip.	107.0
System Project Mgmt.	19			
System Engineering				
Contractor		1	10% of Comm. Equip.	213.9
FCRC		1	2 project years x 2.5 staff-years per project	
	24	20	year = 5 @ $10,400 x 12	624.0
Project Mgmt.	19	1	10% of Comm. Equip.	213.9
Data	20	1	Reprocurement-Tailored Support	
			Radio $243,000	
			Antenna 37,200	
			Feed 11,345	
			MUX 46,700	
			TCF and PTF 87,025	
			Orderwire 10,700	
			Alarm 370	
			Power 270,000	
			Test Equip. 198,700	
			0.5 X $905,040	452.5
			New Procurement, Unit-Tailored Support Peculiar Support Equip.	
			$106.9/4 sets X 7	187.1

NOTE: For ease in following the above example, the costs obtained from the various tables have not been corrected for inflation to the project year. All estimated costs should be adjusted from the base year to the current or project year using table 38-1.

TABLE 2-3. ACQUISITION COST - SUBSYSTEM PROJECT PLAN X-8X ANALOG TROPO SYSTEM 1GHz (CON.)

Cost-Estimating Structure	Reference Ch.	Table	Value/Computations ($000)	Total ($000)
Operational Site Activation	21			
Contractor Tech Support		1	7% X Comm. Equip.	$ 149.8
Site Construction				
Land Acquisition		2	Not Required	
Site Survey/Site Preparation		2	Not Required	
Buildings/Shelters		4	Base Comm., 6,880 ft^2 X 75 2 @ $516.0 = $1,032.0 Base Comm., 10,410 ft^2 X 75 1 @ $780.8 = $780.8 Pwr. Bldg., 1,000 ft^2 X 360 3 @ $360.0 = $1,080.0	
Foundations, Stands and Pads	10	7	Foundations, 8 @ $11.2 = $89.6	
Fences	21	2	Not Required	
Access Roads		2	Not Required	
Fuel Storage (Underground)		3	5,000 Gal Tank, 2.016 X 5 + 0.359 = $10.4	
Construction Index	36	1	Construction Price Index = 2.3	
Subtotal (Construction)			2.3 X $2992.8	6,883.4
Assembly, Instl., and Checkout Onsite	21	5	40% of Comm. Equip.	855.7

NOTE: For ease in following the above example, the costs obtained from the various tables have not been corrected for inflation to the project year. All estimated costs should be adjusted from the base year to the current or project year using table 38-1.

TABLE 2-3. ACQUISITION COST - SUBSYSTEM PROJECT PLAN X-8X
ANALOG TROPO SYSTEM 1GHz (CON.)

Cost-Estimating Structure	Reference Ch.	Table	Value/Computations ($000)	Total ($000)
Initial Spares and Repair Parts	22	1		
Radios			0.35 x $972.0 = $340.2	
Multiplex			0.25 x $147.2 = $ 36.8	
Antennas			0.10 x $297.6 = $ 29.8	
Other Comm			0.20 x $722.5 = $144.5	551.3
Feed System			$45.4	
Ctrl. System			283.9	
Orderwire			32.1	
Alarm			1.1	
Aux. Pwr.			360.0	
			$722.5	
Transportation	24	8	Electronics Equip.: Radio, MUX, TCF, Orderwire, Alarm, Test, & Peculiar Support Equip., Spares & Repair Parts $2,308.4 X 0.10 = $230.8 Antennas, Power, Feed System $703.0 X 0.16 = $112.5 Data (via Parcel Post) $639.6 X 0.01 = $6.4	349.7
Subtotal (Non-Comm. Equip. Costs)				$11,083.1
Total Acquisition Cost				$13,222.4

NOTE: For ease in following the above example, the costs obtained from the various tables have not been corrected for inflation to the project year. All estimated costs should be adjusted from the base year to the current or project year using table 38-1.

TABLE 2-4. ANNUAL OPERATING COST - SUBSYSTEM PROJECT PLAN X-8X
ANALOG TROPO SYSTEM 1GHz

Cost-Estimating Structure	Reference Ch.	Table	Value/Computations	Total ($000)
Military Personnel, Pay and Allowances	23			
Officers		1	1 O-3 @ $37,535	$ 37.5
Enlisted Men		1	3 E-6 @ $22,037	66.1
			35 E-5 @ $18,746	656.1
Operations and Maintenance	24			
Civilian Personnel		1		- -
TDY, Per Diem		6	Per Diem, Worldwide, No Quarters, 35 days @ $50/Day	1.8
			Per Diem, Foreign Travel, 100 days @ $40/Day	4.0
TDY, Transportation	24	6	Commercial Air (Cat Z) 20/O/W Trips @ $830	16.6
Transportation of Things	24	8	O&M, Supplies $ 73,800 Spares $172,200 16% X $246,000	39.4
Utilities and POL	24	13	400kW X 400 hr X 0.0833 = 13.3 KGal. @ $1.03	13.7
Building Maint.	24	22 Para. 7a	$2,897.8 X Area Factor (2.3) X 0.05	322.2
Supplies and Equip.	24	7b 7b	Comm. Equip. $2,139,300 Supt. Equip. 320,800 0.03 X $2,460,100	73.8
Mil. Base Contractual Services	24	22	Comm. & Support Equip., $2,460,100 X 0.003	7.4

NOTE: For ease in following the above example, the costs obtained from the various tables have not been corrected for inflation to the project year. All estimated costs should be adjusted from the base year to the current or project year using table 38-1.

TABLE 2-4. ANNUAL OPERATING COST - SUBSYSTEM PROJECT PLAN X-8X
ANALOG TROPO SYSTEM 1GHz (CON.)

Cost-Estimating Structure	Reference Ch.	Table	Value/Computations[1] ($000)	Total ($000)
Recurring Investment	25			
Replacement Spares		Para. 4	Comm. & Support Equip. $2,460.1 X 0.07	$172.2
Operating Support	26			
Base Operations		1	Navy Personnel, 39 @ $2.97	115.8
Depot Maintenance		3	Comm. & Support Equip. $2,460.1 X 0.005	12.3
Replacement Training[2]		4	39[0.41($6.120 + 0.12($3.876) + 0.47($2.456)] $161.0	161.0
Hospitals		6	39 @ $410	16.0
PCS Travel		7	1 @ $4.2 + 38 @ $1.62	65.8
Total Annual Operating Cost				$1,792.2

[1]For ease in following the above example, the costs obtained from the various tables have not been corrected for inflation to the project year. All estimated costs should be adjusted from the base year to the current or project year using table 38-1.

[2]If known, costs for specific MOS, NEC, or AFSC should be utilized.

TABLE 2-5. TIME-PHASED COST ESTIMATE - PROPOSED PROJECT PLAN X-8X
ANALOG TROPOSPHERIC SCATTER SYSTEMS

Cost Element	FY1	FY2	FY3-10	Total Cost
RDT&E	0	0	0	0
INVESTMENT[1]				
Tropo Radio Equip.	$657.5	$657.5		$1,315.0
Multiplex[2]	100.5	46.7		147.2
Control Systems Equip.	141.9	142.0		283.9
Orderwire	16.1	16.0		32.1
Alarm System	0.6	0.5		1.1
Auxiliary Power[3]	270.0	90.0		360.0
Integration and Assembly	53.5	53.5		107.0
Contractor Training	40.2	26.8		67.0
Test and Support Equip.[4]	160.5	160.4		320.9
System Test & Eval.	53.5	53.5		107.0
System Engineering[5]	701.2	350.6		1,051.8
Data	639.6	0.0		639.6
Assembly, Instl., and Checkout	427.9	427.8		855.7
Initial Spares and Repair Parts	275.7	275.6		551.3
Transportation[6]	194.3	155.3		349.6
MILITARY CONSTRUCTION				
Site Activation	4,588.9	2,294.5		6,883.4
ANNUAL OPERATING				
Military Personnel[7]	419.0	759.7	6,077.6	7,256.3
Operations and Maint.	244.7	489.4	3,915.2	4,649.3
Recur. Investment	86.1	172.2	1,377.6	1,635.9
Operating Support	185.5	370.9	2,967.2	3,523.6
TOTAL SYSTEM COST	$9,257.2	$6,542.4	$14,337.6	$30,137.7

[1]All investments are divided equally between FY1 and FY2 except where noted.
[2]One 24 channel and one 12 channel purchased in FY1; second 12 channel in FY2.
[3]One 100 kw and one 200 kw diesel purchased in FY1; second 100 kw in FY2.
[4]Cost split 3:2 between FY1 and FY2.
[5]Cost split 2:1 between FY1 and FY2.
[6]Differences between FY1 and FY2 costs are reflection of differential purchases of MUX, auxiliary power, and data.
[7]FY1: One officer in charge, two NCOIC's, and 18 technicians; FY2: all personnel.

TABLE 2-6. COST ESTIMATE WORKSHEET - TROPO SCATTER SYSTEM/SITE

TROPO SCATTER SYSTEM/SITE COST ESTIMATE

Proposed Subsystem Project Plan # _____ Date _____
Project Name _____ Prepared by (Org.) _____

System Description _____

Operational Capabilities _____
Time Frame: Acquisition _____ Operations _____
Location _____

ACQUISITION COST

Cost Element Identification	Reference Ch.	Table	Value/ Computation	Total Cost ($000)
Comm. Prime Mission Equipment	10			
Tropo Radio Equip.	10			
Radio Set		6		
Antenna System		7		
Feed System		8		
Multiplex Equip.	11	3		
Control Systems Equip.	13			
Tech Control and Patch and Test		1		
		2		
Orderwire/Intercom		4		

NOTE: Ensure all cost estimates are adjusted for inflation to the current or appropriate year using table 38-1.

TABLE 2-6. COST ESTIMATE WORKSHEET - TROPO SCATTER SYSTEM/SITE

TROPO SCATTER SYSTEM/SITE COST ESTIMATE (CON.)

ACQUISITION COST

Cost Element Identification	Reference Ch.	Table	Value/ Computation	Total Cost ($000)
Alarm System	13	5		
Auxiliary Equipment	14	2		
Electric Power				
Primary Power				
Auxiliary Power				
Subtotal (Comm. Equip.)				$
Integration and Assembly	15	Para. 2a		
Contractor Training	16	1		
Test and Support Equip.	17			
Test and Common Equip.		1		
Peculiar Support Equipment				
System Test and Eval.	18	Para. 2a		
System Project Mgmt.				
System Engineering				
Contractor		1		
FCRC		1		
	24	20		
Project Mgmt.	19	1		

NOTE: Ensure all cost estimates are adjusted for inflation to the current or appropriate year using table 38-1.

TABLE 2-6. COST ESTIMATE WORKSHEET - TROPO SCATTER SYSTEM/SITE

TROPO SCATTER SYSTEM/SITE COST ESTIMATE (CON.)

ACQUISITION COST

Cost Element Identification	Reference Ch.	Table	Value/ Computation	Total Cost ($000)
Data	20	1		
Operational Site Activation	21			
Contractor Tech Support		1		
Site Construction				
Land Acquisition				
Site Survey/Site Preparation		2		
Buildings/Shelters		4		
Foundations, Stands and Pads	10	7		
Fences	21	2		
Access Roads				
Fuel Storage (Underground)		3		
Construction Index	36	1		

NOTE: Ensure all cost estimates are adjusted for inflation to the current or appropriate year using table 38-1.

TABLE 2-6. COST ESTIMATE WORKSHEET - TROPO SCATTER SYSTEM/SITE

TROPO SCATTER SYSTEM/SITE COST ESTIMATE (CON.)

ACQUISITION COST

Cost Element Identification	Reference Ch.	Table	Value/ Computation	Total Cost ($000)
Subtotal (Construction) Assembly, Instl., and Checkout Onsite	21	3		
Initial Spares and Repair Parts	22	1		
Radios				
Multiplex				
Antennas				
Other Comm				
Feed System				
Ctrl. System				
Orderwire				
Alarm				
Aux. Pwr.				
Transportation	24	8		
Subtotal (Non-Comm. Equip. Costs)				$
Total Acquisition Cost				$

NOTE: Ensure all cost estimates are adjusted for inflation to the current or appropriate year using table 38-1.

TABLE 2-6. COST ESTIMATE WORKSHEET - TROPO SCATTER SYSTEM/SITE

TROPO SCATTER SYSTEM/SITE COST ESTIMATE (CON.)

ACQUISITION COST

Cost Element Identification	Reference Ch.	Table	Value/ Computation	Total Cost ($000)
Military Personnel, Pay and Allowances	23			
Officers		1		
Enlisted Men		1		
Operations and Maintenance	24			
Civilian Personnel		1		
TDY, Per Diem		6		
TDY, Transportation	24	6		
Transportation of Things	24	8		
Utilities and POL	24	13		
Building Maint.	24	22	Para. 6a	
Supplies and Equip.	24	7b		
Mil. Base Contractual Services	24	22		

NOTE: Ensure all cost estimates are adjusted for inflation to the current or appropriate year using table 38-1.

TABLE 2-6. COST ESTIMATE WORKSHEET - TROPO SCATTER SYSTEM/SITE

TROPO SCATTER SYSTEM/SITE COST ESTIMATE (CON.)

ACQUISITION COST

Cost Element Identification	Reference Ch. Table	Value/ Computation[1]	Total Cost ($000)
Recurring Investment	25		
Replacement Spares		Para. 4	
Operating Support	26		
Base Operations		1	
Depot Maintenance		3	
Replacement Training[2]		4	
Hospitals		6	
PCS Travel		7	
Total Annual Operating Cost			

[1]Ensure all cost estimates are adjusted for inflation to the current or appropriate year using table 38-1.

[2]If known, costs for specific MOS, NEC, or AFSC should be utilized.

TABLE 2-6. COST ESTIMATE WORKSHEET - TROPO SCATTER SYSTEM/SITE

TROPO SCATTER SYSTEM/SITE COST ESTIMATE (CON.)

TIME-PHASED COST ESTIMATE

Cost Element	FY1	FY_	FY_	FY_	FY_	Total
RDT&E						
INVESTMENT						
Tropo Radio Equip.						
Multiplex						
Control Systems Equip.						
Orderwire						
Alarm System						
Auxiliary Power						
Integration and Assembly						
Contractor Training						
Test and Support Equip.						
System Test and Eval.						
System Engineering						
Data						
Assembly, Instl., and Checkout						
Initial Spares and Repair Parts						
Transportation						
MILITARY CONSTRUCTION						
Site Activation						
ANNUAL OPERATING						
Military Personnel						
Operations and Maint.						
Recur. Investment						
Operating Support						
TOTAL SYSTEM COSTS	_____	_____	_____	_____	_____	_____

NOTE: Ensure all cost estimates are adjusted for inflation to the current or appropriate year using table 38-1.

CHAPTER 8. SOFTWARE SYSTEMS

1. General. Software cost estimation is part of the estimation of the cost of an automated system. This chapter addresses only software life cycle costs, and thus, computer equipment costs, site preparation costs, and other costs associated with automated systems such as utilities, administrative costs, and operating costs will not be dealt with here.

2. System Life Cycle Description. The life cycle of a software system can be roughly divided into four stages, each with its own transformation process.

a. During the specification stage, user needs are transformed into specifications for a software system. The specification stage has three substages:

(1) Systems Feasibility. A choice is made among alternative possible systems.

(2) Software Plans and Requirements. Plans are made of what is to be done, when, and by whom.

(3) Product Design. Complete specifications of higher levels of system are produced.

b. During the programming stage, computer code meeting the specifications is developed and tested. The programming stage has two substages:

(1) Detailed Design. Detailed specifications are produced.

(2) Code and Unit Test. Code that meets detailed specifications is developed.

c. During the realization stage, the tested code takes its place in an operational system meeting user needs. The substages of the realization stage are:

(1) Integration and Product Verification. The parts are put together and it is seen that they work together.

(2) Implementation and System Test. The system is made to work in a manner that is satisfactory to the users.

d. During the maintenance stage, discrepancies between actual user needs and systems performance give rise to improvements and modifications to the system or realization of uncorrectable deficiencies of the system.

e. In terms of resources expended, part of the system is purchased or leased while the rest is developed through expenditure of labor. Seven basic types of labor occur most frequently and will serve as the generic labor elements:

(1) Management. The control and coordination of people, time, money, and things.

(2) Systems Engineering. The defining, describing, and determining of the system and its parts.

(3) Programming. The construction of the system.

(4) Test and Evaluation. The examination of the system to ensure that it works as intended.

(5) Writing. The preparation of necessary or obligatory written documents.

(6) Implementation. The activation and user accommodation of a system.

(7) Maintenance. The repair and improvement of the system.

3. Work Breakdown Structure. Several steps and often more than one iteration of each step are needed to arrive at a satisfactory work breakdown structure. The division of a software system into parts and then into generic elements is the first step in creating a work breakdown structure for the software system.

a. For example, consider a cost estimation model for communications systems. It can be thought of as having three parts and be depicted graphically as in figure 8-1. The box labeled "Cost Model" corresponds to the whole of the system. Each box attached to the horizontal line below the top box corresponds to a part of the system. In the same way, boxes corresponding to subparts are attached to the boxes for their corresponding parts.

b. Consider now, table 8-1 for the high level work breakdown structure corresponding to figure 8-1. The key concept to grasp is that the element numbers and names of a work breakdown structure represent a graph. The columns of the work breakdown structure beyond those for the element numbers and element names represent values of the row elements over time. The element numbering system relates the graph and the column of element names. Each period in the element number represents one level below the top in the corresponding graph. For example, element number 1.4.2 is a second-level item. It is located below element 1.4 in the graph. The first-level element 1.4 is located below element 1 which represents the whole of the system. Item 1.4.2.1 is below element 1.4.2. It is labeled "Programming." There is no element below element 1.4. Notice that at the lowest level of the work breakdown structure in table 8-1 are generic elements or parts of the system which are to be purchased or leased rather than developed, such as the Data

Base Package. The columns beyond those for element numbers and element names correspond to stages of the system life cycle. This is appropriate as stages are time divisions of the system life cycle.

c. The objective in breaking down the system into parts and subparts is to arrive at a description of the system in which the lowest level elements can be estimated in terms of staff months or dollars. If the lowest level elements of the work breakdown structure in its current form cannot be comprehended and estimated, then the next step is to divide the generic elements into their components and the stages into substages. See table 8-2 for some typical components of the generic elements. For a full discussion of the meaning of the terms in table 8-2, consult the book Software Engineering Economics by B. Boehm. Once the software system has been broken down into subsystems and they in turn have been broken down into generic elements and these finally into their components, the work breakdown structure is approaching completion. At this point two important considerations arise:

(1) Has anything been left out?

(2) Is anything being counted twice?

d. Refine the Work Breakdown Structure until both of these questions can be answered negatively. Do not feel constrained to use only the generic elements and components listed above. The important thing is to arrive at description of the software system that is complete, contains no duplications, and can be costed out successfully. For an example of a work breakdown structure see table 8-3.

e. It is to be emphasized that the system should be broken down only until it is divided into elements that can be estimated.

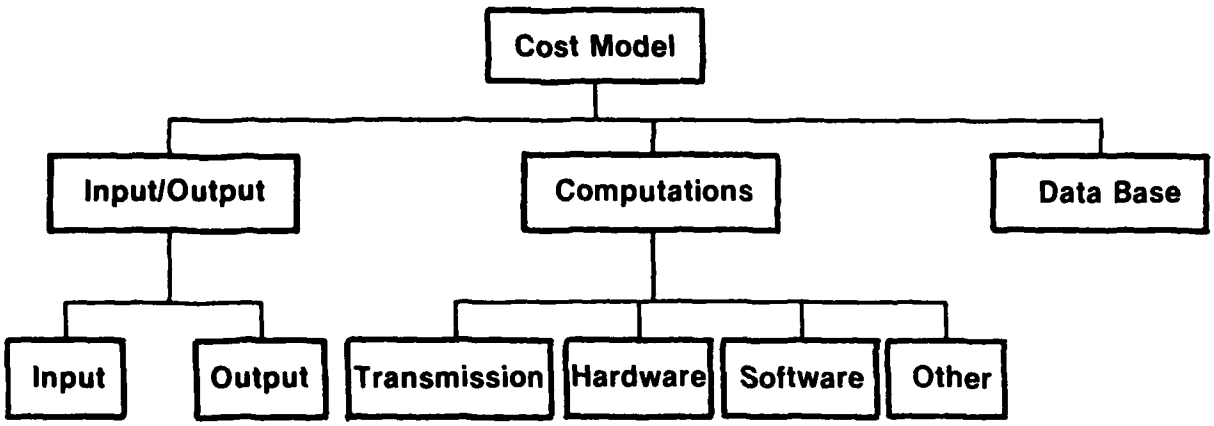

FIGURE 8-1. GRAPHIC REPRESENTATION OF SYSTEM

TABLE 8-1. COST MODEL HIGH LEVEL WORK BREAKDOWN STRUCTURE

	STAGE:	I	II	III	IV
1	Cost Model				
1.1	Management				
1.2	Systems Engineering				
1.3	Test and Evaluation				
1.4	Input/Output				
1.4.1	Input				
1.4.1.1	Programming				
1.4.2	Output				
1.4.2.1	Programming				
1.5	Computation				
1.5.1	Transmission				
1.5.1.1	Systems Engineering				
1.5.1.2	Programming				
1.5.2	Hardware				
1.5.2.1	Programming				
1.5.3	Software				
1.5.3.1	Programming				
1.5.4	Other Costs				
1.5.4.1	Programming				
1.6	Data Base Package				
1.7	Writing				

TABLE 8-2. SUGGESTED SUBELEMENTS

- Management
  - Government Management
    - Project Management
    - Budget Management
    - Contract Management
  - Contractor Management
    - Cost/Schedule/Performance Management
    - Contract Management
    - Subcontract Management
    - Customer Interface
    - Branch Office Management
    - Management Review and Audits
- Systems Engineering
  - Software Requirements
  - Software Product Design
  - Configuration Management and Quality Assurance
  - Feasibility Studies
- Programming
  - Detailed Design
  - Code and Unit Test
  - Integration
- Test and Evaluation
  - Product Test
  - Acceptance Test
  - Test Support
- Writing
  - Manuals
  - Government Required Documentation
- Implementation
  - Installation
  - Conversion
  - Training
- Maintenance
  - Software Update
  - Corrective Maintenance
  - Adaptive Maintenance
  - Perfective Maintenance
  - Data Base Administration

TABLE 8-3. COST MODEL WORK BREAKDOWN STRUCTURE

	STAGE:	I	II	III	IV
1	Cost Model				
1.1	Management	(Included in Indirect Labor Cost)			
1.2	Systems Engineering	3	1		
1.2.1	Software Requirements	2			
1.2.2	Quality Assurance			4	3
2					
1.3	Test and Evaluation				
1.3.1	Product Test		2	5	3
1.3.2	Test Support		3	4	4
1.4	Input/Output				
1.4.1	Input				
1.4.1.1	Programming				
1.4.1.1.1	Detailed Design	1	2	2	2
1.4.1.1.2	Code and Unit Test		3	2	2
1.4.1.1.3	Integration		1	1	1
1.4.2	Output				
1.4.2.1	Programming				
1.4.2.1.1	Detailed Design	1	3	1	1
1.4.2.1.2	Code and Unit Test		4	2	2
1.4.2.1.3	Integration		1	1	1
1.5	Computation				
1.5.1	Transmission				
1.5.1.1	Systems Engineering	4			
1.5.1.2	Programming				
1.5.1.2.1	Detailed Design	2	3	2	1
1.5.1.2.2	Code and Unit Test		4	2	2
1.5.1.2.3	Integration		1	3	1
1.5.2	Hardware				
1.5.2.1	Programming				
1.5.2.1.1	Detailed Design	2	4	2	1
1.5.2.1.2	Code and Unit Test	2	5	2	2
1.5.2.1.3	Integration		2	2	1

TABLE 8-3. COST MODEL WORK BREAKDOWN STRUCTURE (CON.)

	STAGE:	I	II	III	IV
1.5.3	Software				
1.5.3.1	Programming				
1.5.3.1.1	Detailed Design		3	3	2
1.5.3.1.2	Code and Unit Test		3	2	2
1.5.3.1.3	Integration		2	2	1
1.5.4	Other Costs				
1.5.4.1	Programming				
1.5.4.1.1	Detailed Design		2	1	1
1.5.4.1.2	Code and Unit Test		2	2	1
1.5.4.1.3	Integration		1	2	1
1.6	Data Base Package				
1.6.1	Lease Cost	($8,000 / Fiscal Year)			
1.6.2	Programming				
1.6.2.1	Integration		3	2	1
1.7	Writing				
1.7.1	Manuals	1	4	3	2
1.7.2	Other Documentation	3	2	2	2

4. Methods. Three basic methods of costing out a software system are outlined below, each producing estimates of staff months of effort. (See section 9 below for methodology for turning the staff months of effort to cost estimates and suggestions regarding the use of computerized estimating models.)

a. If there has already been discussion of what the system is to do and how it is to do it, then a reasonably complete work breakdown structure can be created and the Bottom-up method of estimation followed. Such a work breakdown structure is an excellent tool for managing and controlling the development of the system, especially when its staffing and scheduling implications are considered.

b. When only gross figures about the size of the system and its complexity are known, the Program Statements approach can be used.

c. The Staffing Profile approach can be used in different ways for different purposes. If only the amount of resources and length of time to complete a project are known, the Staffing Profile approach can, together with a rudimentary work breakdown structure, be used to make budget estimates about optimal resource expenditure rates. Used with a more thorough work breakdown

structure, it can be a tool to control resource expenditures and determine if a project under way will be completed on time and within budget. Methods for realizing the fuller capabilities of the staffing profile method are not treated here.

d. When there is sufficient organizational history and stability, computerized cost models can be used to estimate costs and determine feasibility of schedules. Computerized models are also useful in making estimates of what it will cost a non-Government contractor to develop a proposed system, when sufficient past experience with the contractor is available.

5. Bottom-Up Approach. Starting with a work breakdown structure, estimate the number of staff months needed for each of the lowest level rows of the work breakdown structure. This is best done by discussion with people similar to those who will do the work, and by analogy with similar efforts done in the recent past. Use of the generic elements suggested above will make it easier to relate the staff months to costs. See section 9 for guidance on converting staff month estimates into dollar estimates, and for an example of using this methodology.

6. Program Statements Approach. One software costing method is first to estimate the number of program statements, then use rules of thumb about programmer productivity to estimate the number of staff/months of effort, and lastly derive costs from staff/months. Connected with this method are the following rules of thumb, to be used when no better information is available. Keep in mind that this method does not lessen the need for a clear work breakdown structure, but aids in assigning costs to parts of the work breakdown structure.

a. To perform the Systems Engineering, Programming, Test and Evaluation, and Corrective Maintenance requires:

(1) 3 hours per program statement for programs written in machine language or assembler language.

(2) 1.87 hours per program statement for programs written in high order languages.

b. Using 168 hours per staff month, this comes to 90 program statements per staff month in a high order language or 56 program statements per staff month in assembler language. Once the staff months of assembler language programming and of high order language programming are known, the methods of section 9 below can be used to produce a cost estimate.

c. Example: A software project is estimated to require 6,000 statements in FORTRAN and 400 statements in assembly language.

High order language portion:
6000 statements divided by 90 statements/staff month = 66.67 staff/months

Assembler language portion:
400 statements divided by 56 statements/staff month = 7.14 staff/months

The number of staff months to perform Systems Engineering, Programming, Test and Evaluation, and Corrective Maintenance is now known. It is assumed that Maintenance other than Corrective Maintenance will be estimated separately from this estimate. To arrive at a cost estimate derived from these computations, additional staff months to do Writing and Implementation must be added.

d. It is crucial to observe that the above estimates for program statements per staff month include Corrective Maintenance. This is done since the estimates developed in this chapter deal in terms of life cycle cost. Contractors will claim much higher productivity, but to arrive at an error-free code usually requires a long period of Corrective Maintenance or an expensive Independent Verification and Validation effort. See section 10 of this chapter for more on Independent Verification and Validation costs.

e. The above method calls for estimating four types of quantities.

(1) Schedule.
(2) Programmer Productivity.
(3) Software Product Size.
(4) Cost of Programmer Labor.

f. Note that the methods use the same factors for whatever the time constraints and dimensions of the task. The cost of programmer labor can be estimated with fair accuracy, although it is important to be aware of local variations. However, estimates of programmer productivity and software product size are subject to wide variations and great controversy.

g. The following comments bring out some of the difficulties in estimating software cost.

(1) Two programmers can differ in productivity by a factor of as high as forty.

(2) As the size of a programming project's staff increases, the role of the organization increases and eventually becomes dominant. This starts to occur in a project involving three or more people.

(3) For a small software project, the programmer's name is the only dependable cost driver and acquaintance with the programmer's earlier work the only suitable basis for estimation.

(4) For a larger project, the crucial factor is how well the organization has done on projects of similar size and complexity.

(5) Quantitative measures of code are often ambiguous and misleading because lines of code, number of program statements, number of words all give different values. Further, a good programmer does more with less code, but too clever a programmer can produce code that is hard to maintain.

(6) Time and people are not readily exchangeable. For example, what 20 people can do in one year, 40 people often cannot do in 6 months.

(7) When schedule is shortened excessively, cost increases dramatically.

(8) In fact, there is a minimum time in which a software project can be completed. This is best expressed in Brooks's law which states that when a large project is behind, adding more people often makes it further behind.

g. It is apparent from the above that the time and effort of a software project are not usually linearly related. Therefore, methods of estimation based on multiplying by rates or rules of thumb are generally not very accurate. This leads us to seek other ways of estimating software costs.

7. Staffing Profile Approach. It has been observed that in the more successful software projects when the number of people working on the project is graphed against time there is a rapid buildup to a peak and then a more gradual decline. The graphing of the number of people working on a project against time gives the staffing profile of the project. Some see such curves as resembling the graph of the Rayleigh distribution, others as resembling the graph of the sech^2 curve, or more than one lagged Rayleigh distribution curves. See figure 8-2 for an example of such a graph.

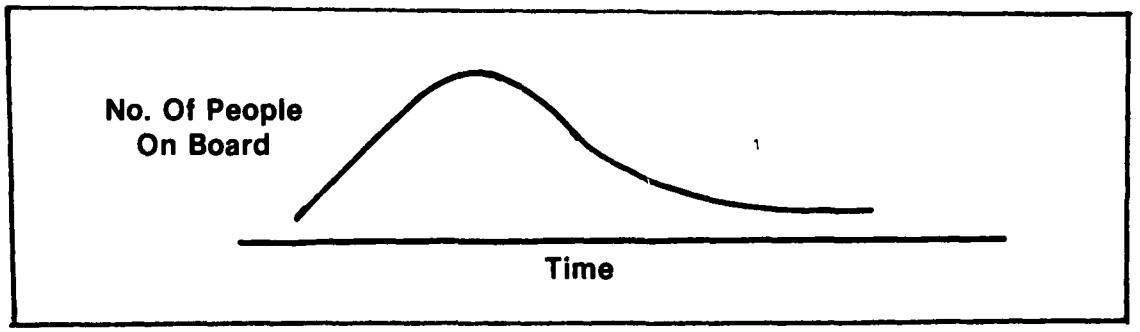

FIGURE 8-2. STAFFING PROFILE CURVE

a. Real staffing profiles do not start at zero. Cutting off the beginning and end of a Rayleigh curve gives a good picture of the staffing profile of a well run software project. Poor management will result in a distorted shape. For instance, if delays due to bad planning occur, there may be a flat stretch in the curve, or the number of people in at the start may be too great and the curve will actually decline throughout its course. But assuming good management, a truncated Rayleigh curve is acknowledged to be the best estimation of the staffing profile. There is some debate about when in the software life cycle the peak of the curve occurs, but sometime during the code and unit test subphase seems most reasonable.

b. Note that the area under the staffing profile curve between two points in time represents the amount of labor expended on the project between the two points in time. The area under the curve includes all Systems Engineering except for Feasiblility Studies, all Programming, the basic Writing needed for documentation and user training, all Implementation, Management directly dedicated to this software system, and Corrective Maintenance. It is still advised to develop a clear and thorough work breakdown structure.

c. Thus, the portion of software system costs described in the previous paragraph can be estimated as follows:

(1) Draw a likely staffing profile for the software project.

(2) Approximate it by a step function (see figure 8-3).

(3) Determine the area under each constant portion of the step function by multiplying length times height. This area is the number of staff months for the time the function is constant.

(4) Add up the number of staff months.

(5) Apportion the staff months according to category of effort.

(6) Multiply by the cost per staff/month appropriate to category of effort and fiscal year.

d. Alternatively, the area can be determined analytically and values computed for each month.

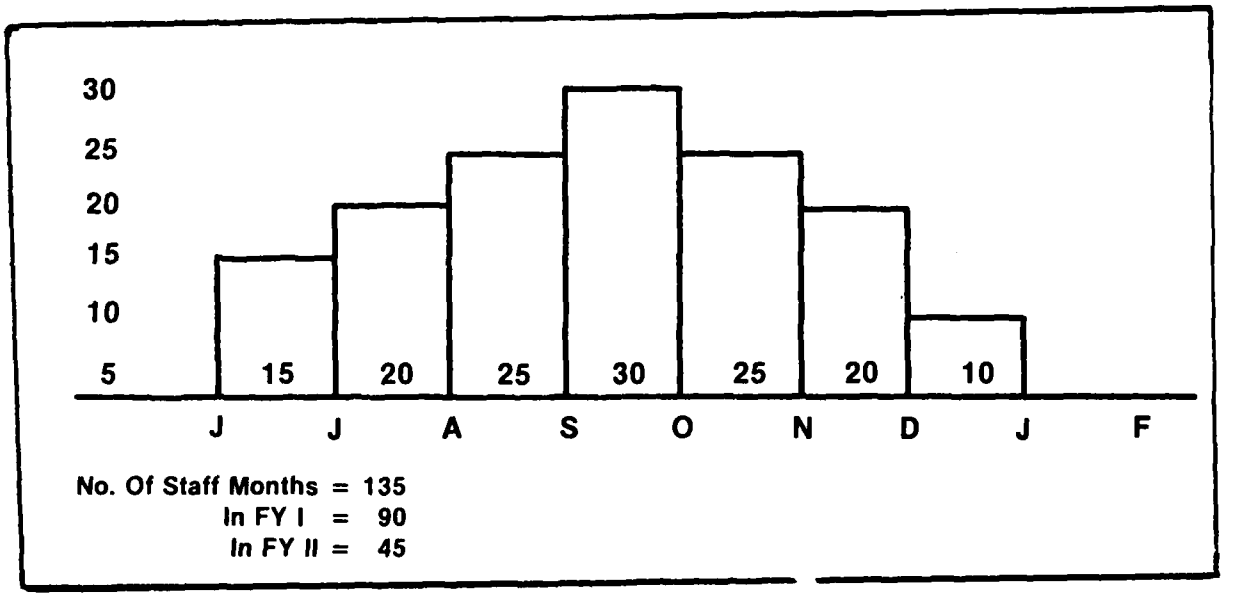

FIGURE 8-3. STEP APPROXIMATION TO STAFFING PROFILE CURVE

e. The chief and obvious weakness of this method is the difficulty in answering the question: Why this particular curve for our project? In other words, even granting that the staffing curve has the shape of truncated Rayleigh curve, why is the curve chosen to estimate the project staffing better than other possible curves? The answer to the question is to provide data of similar projects that have resulted in similar curves, and to establish a connection between the curve you are using and the actual curve for similar projects completed under similar conditions.

f. When sufficient data about analogous projects is available, but it is not clear what curves best describe the project at hand, using one of the existing software cost estimating models can be helpful.

8. Models. A software cost estimating model is a collection of equations, data, and supporting documentation, usually incorporated in computer programs, that will produce an estimate of software project cost from user-provided data. A software cost estimation model cannot be expected to give estimates with any credibility unless it can be calibrated to the environment of the project being estimated. This is due to the impact of differences in programmer productivity and in management style and capability.

a. The best feature of cost estimating models is that once they are properly calibrated and fed correct data, they provide a good way of justifying and objectifying the process of deciding which schedule and costs will be best. The focus of discussion can be shifted to the validity of the input data as a representation of the software project.

b. The most important question when using a cost model is to be clear about what portion of the total software project cost is included in the estimate produced by the model. In other words, using a model does not replace a work breakdown structure but only aids in filling in cost figures for some elements.

c. Other concerns in using a model are:

(1) The model may not allow you to take budgetary and political considerations into account that force the choice of certain staffing strategies. It can, however, point out when certain proposed schedules and staffing plans are infeasible for accomplishing the project.

(2) Some models have critical points or highly sensitive dimensions. In other words, small changes in data can produce large changes in cost estimate. Be sure and vary your input data to see if you are close to one of these sensitive points.

(3) Some of the input variables may not be meaningful or measurable in the case at hand. Care must be taken that such variables do not drive the cost estimate. A reasonable range of values for variables that cannot be assigned values must be assumed and the model run repeatedly over this range with some kind of averaging of the results being done. Not to do this is to allow random choices or default values to drive the estimate.

9. Producing Cost Estimates. In this section the steps leading from a work breakdown structure to a completed cost estimate are described.

a. The first thing to be estimated is the schedule. This consists in deciding when each substage in the software life cycle will begin and when it will end. In a well-run software system, the stages do not overlap. If it is seen that the stages will overlap in a program being estimated, a significant increase in the costs should be estimated.

b. Using the estimated schedule, the work breakdown structure is modified so that the headings for the columns beyond those for element number and element name are no longer stages or substages but fiscal years. In this modified work breakdown structure, each intersection between a row containing one of the lowest level elements and a column corresponding to a fiscal year contains the number of staff months of the element to be used in the fiscal year or the amount to be paid in that fiscal year for elements of the system to be purchased or leased. See table 8-5 for an example of such a modified work breakdown structure based on table 8-3.

c. It is now necessary to determine the cost of a staff month for one of the elements in a given fiscal year. If such information is known proceed to the next paragraph; otherwise, use the following methodology. Consult table 8-4 to convert generic labor elements into the labor categories in table 24-18. Use the cost data in table 24-18, taking note of the base year of the table. Use the methods outlined in chapter 38 to change staff month costs from one fiscal year to another.

d. Determine the costs of a higher level row by adding up the costs of the lower level rows below it. Do not assign costs directly to a higher level row. In this way the cost of the system will be determined.

10. Other Considerations. This section discusses adjustments to the estimating methodology when a variety of special circumstances apply. Among these are extreme criticality of correct system performance, the decision to do system maintenance separately from development, and awareness that the system as currently conceived will require regular change.

a. If only the cost of developing the software system and not the cost of installing it and doing corrective maintenance on it are to be estimated by the program instructions approach, the following rules of thumb can be used:

350 program lines per staff month for uncomplicated programming in High Order Languages.

200 program lines per staff month for more complicated programming.

When using this approach, it is important to estimate installation and corrective maintenance costs separately.

b. When the consequences of program failure during operation are extreme, or when the complexity of the programming makes error correction costly or difficult, the use of Independent Verification and Validation is advised. Verification is performed concurrently with the respective phases of software system development to ensure that the system under development performs its intended functions and does not perform unintended functions. Validation ensures that the user's stated operational requirements are satisfied by the developed software. Independence means that the Verification and Validation are pursued by people not directly under the authority of those developing the software system. The cost of Independent Verification and Validation depends on its intensity. If the software is extremely critical, the cost is equal to 40 percent of the development cost of the software system. However, most of the corrective maintenance will not be needed, and should be subtracted out before the 40 percent computation is made. Normal Independent Verification and Validation costs 20 percent of the development cost. In normal Verification and Validation, there is some involvement by the independent agent in every phase of system development. Again, the cost of corrective maintenance should be subtracted out first, but with normal Independent Verification and Validation some corrective maintenance will still be required and should be added back in after the 20 percent computation is made. Minimal Independent Verification and Validation occurs mostly during the Test portion of System Development. Its cost is estimated at 10 percent of system development cost. The reduction in corrective Maintenance due to Minimal Independent Verification and Validation is probably not significant since mistakes found in the testing stages of development cost approximately the same to repair as those found after installation.

c. Maintenance other than Corrective Maintenance is estimated as a separate software development process. However, such work is often done on a level-of-effort basis with labor or money predetermined for each fiscal year after the system is functioning correctly. If this is the case, then the costs should be included in the software system life cycle cost.

Table 8-4. STAFF MONTH CONVERSION TABLE

One staff month of	is equivalent to
Management	One staff month of a Senior Analyst for a medium system. One staff month of a Senior Engineer for a large system.
Systems Engineering	One staff month of a Midlevel Analyst for routine Systems Engineering. One staff month of a Senior Analyst for more complicated Systems Engineering.
Programming	One staff month of a Junior Programmer for all but the most advanced high order languages. One staff month of a Senior Programmer for Assembler Language Programming.
Test and Evaluation	One staff month of a Senior Technician.
Writing	Average of one staff month of a Senior Technician and one staff month of the type of programming being documented.
Implementation	One staff month of a Senior Programmer.
Maintenance	One staff month of whatever type of programming being done.

TABLE 8-5. MODIFIED WORK BREAKDOWN STRUCTURE

	FY:	86	87	88	89
1	Cost Model				
1.1	Management	(Included in Indirect Labor Cost)			
1.2	Systems Engineering	3	1		
1.2.1	Software Requirements	2			
1.2.2	Quality Assurance		4	2	1
1.3	Test and Evaluation				
1.3.1	Product Test		7	2	1
1.3.2	Test Support		7	2.5	1.5
1.4	Input/Output				
1.4.1	Input				
1.4.1.1	Programming				
1.4.1.1.1	Detailed Design	1	4	2	
1.4.1.1.2	Code and Unit Test		5	1	1
1.4.1.1.3	Integration		2	1	
1.4.2	Output				
1.4.2.1	Programming				
1.4.2.1.1	Detailed Design	1	4	1	
1.4.2.1.2	Code and Unit Test		6	1.5	.5
1.4.2.1.3	Integration		2	1	
1.5	Computation				
1.5.1	Transmission				
1.5.1.1	Systems Engineering	4			
1.5.1.2	Programming				
1.5.1.2.1	Detailed Design	2	5	1	
1.5.1.2.2	Code and Unit Test		6	1.5	.5
1.5.1.2.3	Integration		4	1	
1.5.2	Hardware				
1.5.2.1	Programming				
1.5.2.1.1	Detailed Design	2	6	1	
1.5.2.1.2	Code and Unit Test	2	7	1.5	.5
1.5.2.1.3	Integration		4	1	

TABLE 8-5. MODIFIED WORK BREAKDOWN STRUCTURE (CON.)

	FY:	86	87	88	89
1.5.3	Software				
1.5.3.1	Programming				
1.5.3.1.1	Detailed Design		6	1.5	.5
1.5.3.1.2	Code and Unit Test		6	1.5	.5
1.5.3.1.3	Integration		4	1	
1.5.4	Other Costs				
1.5.4.1	Programming				
1.5.4.1.1	Detailed Design		3	1	
1.5.4.1.2	Code and Unit Test		3	1	
1.5.4.1.3	Integration		3	1	
1.6	Data Base Package				
1.6.1	Lease Cost	($8,000 / Fiscal Year)			
1.6.2	Programming				
1.6.2.1	Integration		5	1	
1.7	Writing				
1.7.1	Manuals	1	7	1.5	.5
1.7.2	Other Documentation	5	4	1	1

NOTE: This table is based on table 8-3. It is assumed that Stage I is done in fiscal year 1986, Stages II and III are done in fiscal year 1987, and Stage IV occurs during fiscal years 1988 and 1989.

CHAPTER 11. MULTIPLEX EQUIPMENT

1. Digital Multiplex.

a. General. The DCS currently uses two main levels of digital multiplex equipment, the AN/FCC-98(V) (level 1) and the AN/FCC-99 (level 2). The level 1 multiplexer will accept up to 24 VF analog channels and produce one 1.544 Mb/s bit stream. The level 2 multiplexer will accept from two to eight 1.544 Mb/s bit streams from the level 1 multiplexer for input to the digital radio. The digital radios will accommodate either one or two level 2 output bit streams plus an optional 192 Kb/s service channel bit stream.

b. Level 1 Multiplexer. The AN/FCC-98(V) (formerly TD-1192) is the standard DCS level 1 multiplex. The AN/FCC-98(V) consists of a basic unit that has 24 ports, each of which will accept a VF card. The multiplexer pulse code modulates and time division multiplexes (PCM/TDM) the 24 ports into one bit stream of up to 1.544 Mb/s. Up to 12 of the ports can be configured into various combinations of digital data channels. The digital data channels cannot together exceed a total bit rate of 768 Kb/s in the bipolar mode. Cards are available to provide synchronous 56, 64, 128, and 512 Kb/s channels. Lower bit rate cards are available for asynchronous 0 to 20 and 50 Kb/s channels; however, each of these cards uses a full port.

c. Level 2 Multiplex. The AN/FCC-99 (formerly TD-1193) is the standard DCS level 2 TDM multiplexer. The AN/FCC-99 has eight input ports each capable of accepting 1.544 Mb/s. Two 1.544 Mb/s ports may be strapped to yield a single 3.088 Mb/s port, and four 1.544 Mb/s ports may be strapped to yield a single 6.176 Mb/s port. The input bit streams are combined into a single output bit stream of 3.232, 6.464, 9.696, or 12.928 Mb/s.

d. Service Channel Multiplexer. The service channel multiplexer provides two voice channels (64 Kb/s) and one telemetry channel (64 Kb/s) combined into one 192 Kb/s digital bit stream. The service channel connects directly to the digital radio and provides all the supervisory and telemetry functions for the O&M of the system. One service channel multiplexer is required for each digital radio. The AN/FCC-98(V) can be configured to function as a service channel mux.

e. Sublevel Multiplexer. To allow low speed DC devices, such as TTY terminals, to interface efficiently, a Low Speed Time Division Multiplexer (LSTDM) is used. The LSTDM is now designated AN/FCC-100. The LSTDM accommodates up to 16 low speed DC users with input speeds per port of up to 2400 b/s asynchronous and from 75 b/s to 64 Kb/s synchronous. The LSTDM combines the inputs and produces an output bit stream at rates from 1.2 Kb/s to 256 Kb/s.

f. Use of Tables. Figure 11-2 shows the connectivity of the AN/FCC-98(V) and the AN/FCC-99 to the digital radio. Table 11-1 contains the unit costs of the components of the AN/FCC-98(V) and the AN/FCC-99. These costs may be aggregated to estimate the costs of a complete new site or to add voice or

data channels to an existing PCM/TDM multiplex. For example, the site shown in figure 11-2 will provide channel breakouts at the voice level for 192 analog voice channels. This site also receives, regenerates, and "thru-groups" a combined bit stream of 12.928 Mb/s. (No multiplex costs are required for the "thru" digital bit stream @ 12.928 Mb/s.) Figure 11-2 presents a schematic drawing of the site. Costs for the digital multiplex at this site will be estimated as follows:

AN/FCC-98(V)		
Basic Unit (includes 24 VF channel cards)	16 ea @ $24,499 =	$391,984
AN/FCC-99		
Basic Unit	2 ea @ $50,272 =	100,544
1.544 Mb/s Channel Cards	32 ea @ $ 858 =	27,456
Service Channel Multiplex		
	2 ea @ $16,760 =	33,520
Total Site Digital Multiplex		$553,504

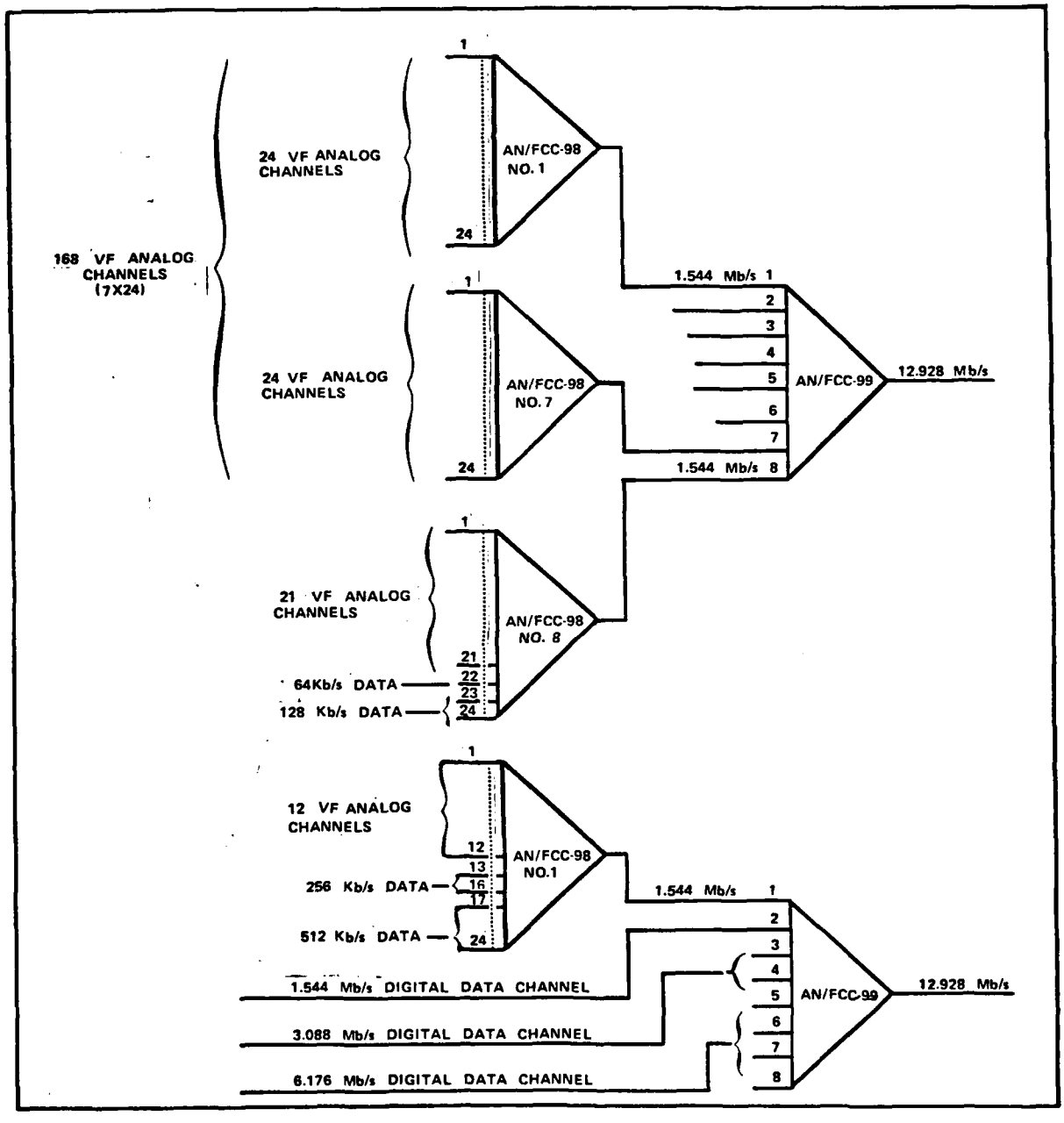

FIGURE 11-1. DIGITAL MULTIPLEX BLOCK DIAGRAM

NOTE: NOT A TYPICAL OR APPROVED CONFIGURATION. DRAWN ONLY TO ILLUSTRATE POSSIBLE DATA BIT RATES AND THEIR REQUIRED PORT STRAPPING.

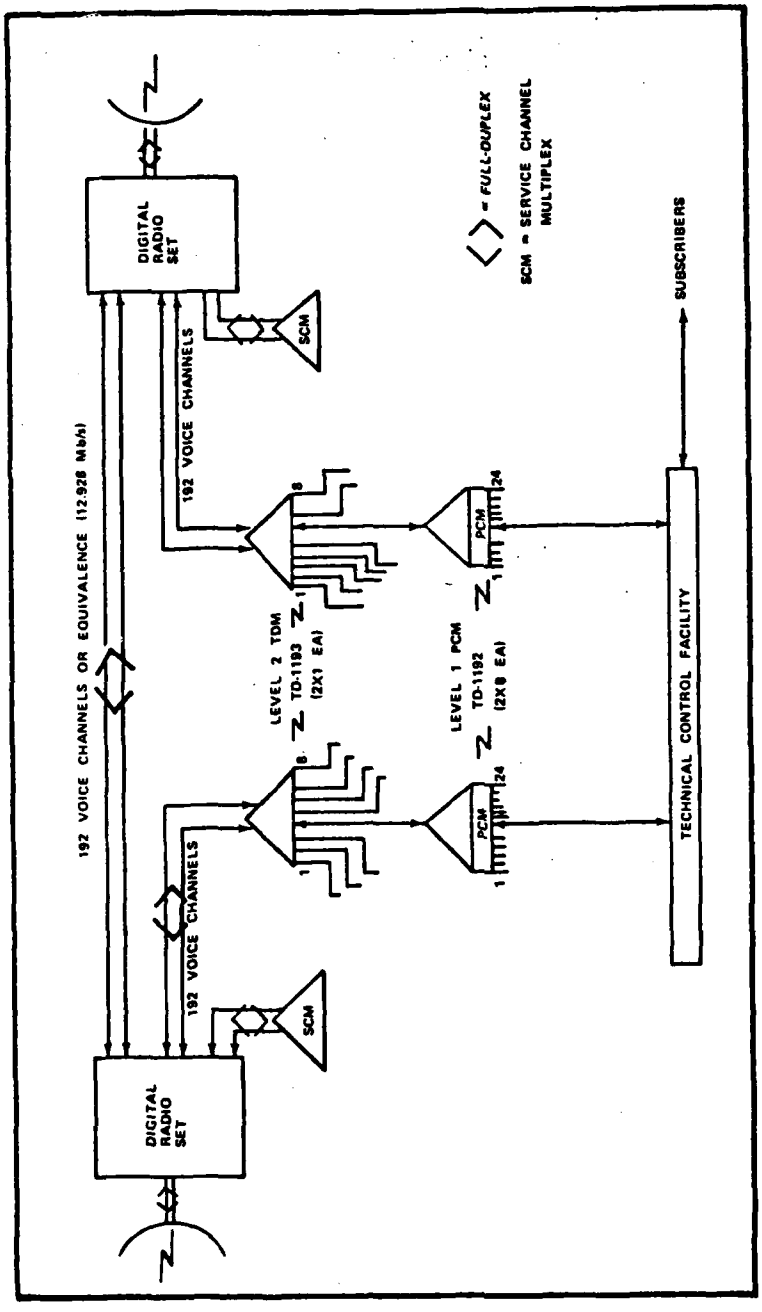

FIGURE 11-2. EXAMPLE SITE CONFIGURATION

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TABLE 11-1. PCM/TDM EQUIPMENT

	Unit Cost[1]	Maximum Configuration Voice Channels (384 ea.) Qty[2]	Cost[3]
AN/FCC-99			
Basic Unit	$50,272	2	$100,544
Cards			
1.544 Mb/s	858	32[4]	27,456
3.088 Mb/s	858	--	
6.176 Mb/s	858	--	
			$128,000
AN/FCC-98(V)			
Basic Unit[5]	$24,499	16	391,984
Single Channel Unit Cards			
0-20 Kb/s	380	--	
50 Kb/s	596	--	
56/64/128/256/512 Kb/s	671	--	
Voice Frequency	380	--	
T/R Timing Groups	3797	--	
Electrical Equip Cabinet	7798	--	
Power Supply Group	2083	--	
Test Set (BITE)	1651	--	
			$391,984
Service Channel Multiplexer			
Basic Unit with 2 VF and 1 data channel	$16,760	1	$ 33,520
Total			$553,504

[1]Costs are all base year FY 85. Source 1 was used for the AN/FCC-99 and source 2 for the remainder.
[2]Unadjusted costs quoted are maximum figures and additional discounts may be received for cumulative and volume purchases.
[3]Ensure appropriate adjustment factors are applied to all components, where applicable, to bring all costs to common project year prior to final summation.
[4]Redundant cards are required for each port.
[5]Basic multiplexer unit includes transmit-receive timing group, power supply group (DC), test set (BITE), electrical equipment cabinet, and 24 voice frequency channel modules.

Sources: 1. ISMA, Fort Monmouth.
2. AN/FCC-98(V)--Contract #DAAB07-84-D-D001, 31 Jul 84.

TABLE 11-2. FDM (AN/UCC-4) RACK CAPACITIES

Rack Designator	Number of Channels 1-60	61-120	121-180	181-240	241-300
1- OA-8373(V)/UCC-4	x	x	x	x	x
2- OB-26(V)/UCC-4	x	x	x	x	
3- OB-31(V)/UCC-4	x	xx	xxx	xxxx	xxxxx
4- OA-8370(V)/UCC-4	x	x	xx	xx	xxx
5- OA-8367(V)/UCC-4	x	x	x	xx	xx
6- OB-29(V)/UCC-4					x
7- OB-30(V)/UCC-4					x

Each rack identified (x) is equipped at its basic or lowest level, and incremental equipment must be added to increase its capacity as shown in table 11-4. Table 11-3 presents the cost for some basic terminals.

Source: DCEO Standard Rack Configuration, 19?2; DCA, Code 690.

CHAPTER 20. TECHNICAL AND MANAGEMENT DATA ACQUISITION

1. General. The cost of required technical and management data significantly influences total acquisition costs for equipment, systems, and projects. Data costs have little effect on procurement costs for commercial, off-the-shelf items of equipment. However, costs are affected more if the acquisition involves procurement of commercial equipment for integration into systems, and the cost data becomes very significant when the acquisition includes development of equipment and systems. These acquisitions involve more detailed specifications, integrated logistic support planning, configuration documentation, technical manuals, and test plans and reports. The greatest cost implications of all occur if the newly developed equipment and systems are to be placed in follow-on production. In the acquisition of technical studies and management support services, the only deliverable products are data and information, therefore, the total acquisition cost relates to data requirements and it is essential that data requirements be considered from the outset of project planning.

2. Data Requirements Application in Contracts. Data requirements in the acquisition process are considered public reporting subject to Public Law 96-511, the Paperwork Reduction Act of 1980. Under that authority OMB has approved the Data Item Descriptions (DID), and their source documents, and has included them in the DoD Acquisition Management Systems and Data Requirements List (AMSDL) for use in defining data requirements in the acquisition process. OMB also approved the Federal Acquisition Regulation (FAR) and DoD Supplement to the FAR (DFARS) for use in ordering data. Part 52 of those documents includes the clauses which apply when data requirements are made a part of a contract.

3. Derivation of Cost Factors. The nature of the acquisition cost of data was discussed in paragraph 1. There are other factors, however, which must be considered:

a. Price Group. In relation to the acquisition process, all data falls into one of four groups which strongly influence the cost of the data. These groups are identified on the reverse side of DD Form 1423, and the appropriate group for each data item is entered in block 25 on the front of the form. The groups are:

(1) Group I. Includes technical manuals prepared exclusively for military (Government) use. The total cost of their preparation and maintenance by the contractor is properly charged to the Government.

(2) Group II. These are data essential to the performance of the primary contracted effort but for which the contractor is required to perform additional work to make the deliverable product conform to Government requirements with regard to depth of content, format, frequency of submittal, preparation, and control or quality of the data item. The Government should not be charged for preparation of data required by the contractor for internal use in support of contractual work. The cost of these data are properly

included in the proposed cost for the work effort itself. Accordingly, the cost of group II data should cover only additional effort required to put these deliverables into the form required by the Government.

(3) Group III. Data which the contractor must develop for internal use in performance of a primary contracted effort that does not require any substantial change for delivery to the Government. The cost of these data should be limited to administrative costs for reproduction and delivery. These data are less costly than group II data.

(4) Group IV. Data which is developed by the contractor as part of normal operating procedures and for which the effort in supplying these data to the Government is minimal. Normally these items are provided at no cost.

b. Scope of Project Applicability, Size, Complexity, and Life Expectancy. The cost of data will normally reflect the size and complexity of the project and the scope and time span of its applicability. Documentation on simple and uncomplicated hardware and software when the data will be applicable only to a single location for a limited period of time can be of minimum volume and detail and will be less costly. Documentation of R&D software developed for short-term use in a single laboratory can be abbreviated and of reduced detail. Conversely, documentation of complex software which is to be operated and maintained at many locations for an extended period of time must be standardized and detailed and will be much more costly. The implications of these factors must be considered in estimating technical data cost.

4. Cost Estimating Procedures. Cost estimates in acquisition project plans must include reasonable estimates of the cost of technical and management data requirements in order to avoid inadequate funding through the budget process. These data cost estimates must consider all the variables discussed above. A review of typical projects involving development, follow-on production, and fielding of complex equipment or systems at multiple sites and requiring preparation of technical manuals indicates that technical data costs will add approximately 30 percent to the system acquisition costs. Except in acquisitions involving unusually high levels of group I data requirements, this should represent the highest level of data costs. Estimated cost factors associated with selected levels for each of the variables discussed are provided in table 20-1. This table is designed so that the product of appropriate selected values for cost factors (A), (B), and (C) in the table will establish the appropriate percentage of the estimated acquisition cost that must be added for required technical data. The following guidance applies in estimating project data costs:

a. Nature/Type of Acquisition (Cost Factor (A)). Select the definition which best defines the nature of the planned acquisition project, and record the cost factor assigned. Interpolation may be used if the nature of the acquisition can best be defined as intermediate between two of the definitions.

TABLE 20-1. DATA COST FACTORS

Nature / Type Acquisition (A)	Cost Factor (A)	Price Group (B)	Cost Factor (B)	Applicability Size Complexity Life Span (C)	Cost Factor (C)
Procurement of Commercial or Current Inventory Item	2	I	3	(Hardware or Software)	
		II	1	APPLICABILITY (1)	
Integrated Commercial or Current Inventory Items	3	III	.5	Single Site Multiple Sites	.1 .25
		IV	0	SIZE (2)	
Development of Equipment or System	7			Single Item Integrated System	.1 .25
Development and Follow-on Production	8			COMPLEXITY (3)	
				Simple Complex	.1 .25
Development and Production and Deployment, Siting, and Installation	10			LIFE SPAN (4)	
				Short (0 - 2 Yrs.)	.1
Management/ Engineering Services	0			Medium (2 - 5 Yrs.)	.15
				Long (5+ Yrs.)	.25

MANAGEMENT DATA COST ESTIMATING FACTOR = (D) = 2%

TECHNICAL DATA COST ESTIMATING FACTOR:
(A) X (B) X [(C)(1)+(C)(2)+(C)(3)+(C)(4)] = Tech. Cost Factor

MANAGEMENT DATA COST ESTIMATING FACTOR = (D) = 2%

TOTAL DATA COST FACTOR = Tech. Data Cost Factor + Management Data Cost Factor

b. Price Group (Cost Factor (B)). Select the group that represents the most costly category of data required for the acquisition (i.e., if the requirement will include technical manuals or other data for which the contractor has no internal need, select Group I). Review paragraph 3a for group definitions and select the appropriate cost factor.

c. Applicability, Size, Complexity, and Life Span (Cost Factor (C)). The value of cost factor (C) will be the sum of subfactors (1), (2), (3), and (4). Select the appropriate descriptions for each subfactor and total their values to determine cost factor (C).

d. Computing the Total Technical Data Cost Factor. The total technical data cost factor will be determined using the formula:

(A) X (B) X [(C)(1)+(C)(2)+(C)(3)+(C)(4)] = Tech. Data Cost Factor

e. Management Data Cost Estimate. As indicated in the table, a reasonable cost estimate for management data may be determined as 2 percent of the acquisition cost. The factor of 2 percent for management data should be added to the computed technical data cost factor to determine the total data cost factor for the project.

f. Total Data Cost Estimate. Multiply the total estimated project acquisition cost by the sum of the technical data cost factor and the management data cost factor to determine the estimated data cost. This cost should be added to the estimated project acquisition cost to include the estimated cost of required data.

5. Example. A project is to provide for development, production, and siting of a network of three digital switches to integrate operation of multiple computer sites. Technical manuals will be required. This is to be a permanent (long-term) operational capability. Estimated cost for the acquisition of the switches and required services is $1,000,000. Using table 20-1 cost factor (A), [Development and Production + Deployment, Siting, and Installation] = 10. Cost factor (B) [Group I] = 3. Cost factor (C)(1) [Multiple Sites] =.25; (C)(2) [Integrated System] =.25; (C)(3) [Complex] =.25; and (C)(4) [Long] =.25. Therefore, cost factor (C) = .25 + .25 + .25 + .25 = 1.

Tech. Cost Factor = (10)·(3)·(1) = 30%. Management Data Cost Factor = 2%.

Data Cost = .32 X $1,000,000 = $320,000.

Total Cost Estimate = $1,000,000 + $ 320,000 = $1,320,000.

CHAPTER 21. OPERATIONAL SITE ACTIVATION

1. Introduction. This chapter has been organized into three major areas: contractor activities related to the provision of technical support at the site, the construction of buildings and other supporting facilities, and the effort associated with assembly, installation, and checkout of the equipment at the site. This chapter also addresses real estate, construction, building conversion, utilities, and other equipment used for housing and servicing communications equipment at the site.

2. Contractor Technical Support.

a. General. The contractor technical support discussed herein refers to all materials and services related to activation, such as final turnover and standby services, provided by the contractor.

b. Estimating Procedure.

(1) Base the estimate contractor technical support on the number of man-years of technical support required to complete the site activation task and upon the cost-per-man-year factors presented in chapter 24, table 24-15, for lead and field system engineers, technicians, and clerical support personnel. The appropriate mix of personnel required and the number of personnel per system depend upon unique factors related to the individual system or program.

(2) In the absence of specific cost information, use the factor shown in table 21-1 for the percentage of the prime mission and auxiliary equipment acquisition costs.

(3) Sufficient data to develop manpower requirement factors by type of procurement for this element are unavailable. As additional data are collected in accordance with the work breakdown structure in MIL-STD-881, these estimating procedures will be updated and published in this Circular.

TABLE 21-1. CONTRACTOR TECHNICAL SUPPORT

7% X Prime Mission and Auxiliary Equipment Acquisition Cost

3. Site Construction.

a. General. This element covers the special-purpose facilities necessary to achieve system operational status. It includes real estate, site preparation, and construction of such items as access roads, foundations, buildings, shelters, and supporting facilities. Utilities and other support items are also required at almost all remote communications sites and frequently at sites located on military bases. All of the costs included herein are subject to adjustments for geographical cost differences, covered in chapter 36, table 36-1.

b. Use of Tables.

(1) Table 21-2 presents cost and planning factors for site construction. It reflects costs per unit of specified measurement. Since unit costs for certain construction items reflect both fixed and variable costs, they are sensitive to the total quantity on which they were based. As a result, the unit costs presented may not be valid for items of significantly different total quantity than that presented in the table.

(2) Table 21-3 shows cost-estimating relationships for liquid storage facilities. Costs for POL systems and for water tanks may be calculated by substituting the appropriate value of the relevant parameter into the equation representing the type of storage required. Alternatively, comparisons may be # made for POL storage systems by entering table 21-4 with the appropriate quantity.

(3) Table 21-5 contains building costs for the Washington metropolitan area for sizes as indicated. Variance in costs due to size differences may be determined by referring to figure 21-1. For building outside the Washington metropolitan area refer to chapter 36 and multiply the adjusted Washington, DC, costs by the appropriate area factor to find the unit costs for the specified location.

c. Examples.

(1) POL System. A 5,000 gallon per minute hydrant fueling system is required. Using the CER found in table 21-3, the cost is estimated to be ($1,028 x 5 + $3,555 =) $8,695K or $8.7 million.

(2) Building. A 63,000-square-foot data processing center is to be built in Billings, Montana. Table 21-5 shows costs for a 21,000-square-foot center to be $96 per square foot. The proposed center is three times as large as the typical center. Figure 21-1 shows costs of a building three times as large of the typical size as being 93 percent of the costs of the typical size (per square foot). The adjusted cost per square foot is thus: .93 x $98 = $91. The area factor from table 36-1 is .95; therefore, the cost of the building will be 1.01 x $91 x 63,000 = $5.79M.

TABLE 21-2. SITE CONSTRUCTION

Construction Item	Unit	Unit Price
Land Acquisition	acre	$ 3,000
Site Preparation		
Clearing, 6" Trees, Cut & Chip	acre	2,520
Grading (Rough)	yd^2	3.10
Grading (Fine), 3 Passes, w/Roller	yd^2	0.85
Landscaping		
Topsoil - 6" Haul & Spread	yd^3	3.45
Topsoil - 6" Strip & Stockpile	yd^2	0.40
Grass Seeding, Hydraulic, w/Fertilizer	yd^2	0.70
Grass Sodding	yd^2	4.90
Mulching, Wood Chips	yd^2	1.40
Roads, Streets, Parking Areas	yd^2	
Rigid: 12"		50.00
10"		40.00
8"		31.50
6"		24.50
Flexible		12.04
Concrete Curb & Gutter	ft	18.50
6" Crushed Stone, Gravel	yd^2	5.50
Sidewalks - 4" Concrete	ft^2	3.80
Foundations - Pilings	ft	
Wood (13" diam)		12.90
Concrete (12" or 14" sq)		21.60
" (16" diam)		34.20
" (18" diam)		39.50
Buildings: See table 21-4.		
Towers: See table 10-4.		
Air-Conditioning: See table 14-8.		

TABLE 21-2. SITE CONSTRUCTION (CON.)

Construction Item	Unit	Unit Price
Chain Link Fence (type A, 9 gauge) (incl. 3 Str. Barbed Wire)	ft	
6'		$14.00
8'		16.30
10'		21.10
Gate-Roadway	ea.	
24', Swinging, Pair		4,800
36', Sliding		2,500
Demolition		
Building-Concrete	ft	3.10
Pavement - 6"		7.85
Water Storage Facilities: See table 21-3.		
Fuel Storage Facilities: See table 21-3.		
Sewage Facilities	site	
2,000 gal Septic System		720
5,000 gal Septic System		2,249
Electrical Facilities: See table 14-2.		

SOURCES:
1. "HQ USAF Annual Construction Pricing Guide for FY 85 thru 89 Programs," Jun 82.
2. NAVFAC DM-10, "Cost Engineering Criteria & Cost Data," May 82.
3. EIRS Bulletin 84-01, 29 Jun 84.

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TABLE 21-3. LIQUID STORAGE CERS

Cost Category	CER ($K)	Range (K)
POL Systems (X = K barrels, Q = K gallons, P = K gallons/min.) (Also, see table 21-4 for comparison.)		
Aboveground[1]	$46.21 \times X^{0.8} + 79.4$	$2.5 \leq X \leq 100$
	or	
	$18.01 \times X + 236$	$25 \leq X \leq 250$
Aboveground, w/Floating Pans[2]	$53.2 \times X^{0.85} + 112$	$2.5 \leq X \leq 100$
	or	
	$27.46 \times X + 138$	$50 \leq X \leq 250$
Underground[3]	$1,712 \times X^{0.3} - 2,704$	$10 \leq X \leq 100$
	or	
	$2.016 \times Q + 0.359$	$1 \leq Q \leq 30$
Hydrant Fueling/ Automatic Pressurized[4]	$1,028 \times P + 3,555$	$1.2 \leq P \leq 5.4$
Water Storage (G = M gallons)		
Steel, Stand Pipe[5]	$-5,311 \times Q^{-0.1} + 6,277$	$0.5 \leq Q \leq 2$
Steel, Elevated[6]	$1,573 \times Q + 213$	$0.05 \leq Q \leq 0.75$
Concrete, Ground[7]	$-195.1 \times Q^{-0.4} + 630$	$0.1 \leq Q \leq 1$
Concrete, Reservoir Cavity[8]	$285 \times Q + 214$	$0.25 \leq Q \leq 2$

NOTES: Base Year - FY 1985. 1 barrel = 42 U.S. gallons.
1 Cone roof steel tank; incl. found., dike, and ext. coating.
2 Cone roof steel tank; w/o columns; incl. found., dike, int. epoxy lining, and ext. coating.
3 Vertical steel tank; incl. found., excav., backfill, and epoxy lining.
4 Includes 2 aboveground operational storage tanks.
5 Tank w/found.; excl. ext. piping, pumping, and cathodic protection.
6 Tank, standpipe, 125' tower, valves, w/found.; excl. pump house, pumps, and cathodic protection.
7 Tank w/found.; excl. ext. piping and pumping.
8 Incl. 6" concr. floor slab, ordinary excav., and piping w/in reservoir.

Source: "HQ USAF Annual Construction Pricing Guide for FY 85 thru 89 Programs," Jun 82; DCA, Code 690.

#

TABLE 21-4.

POL STORAGE (BULK)

Cost Category	Quantity	Unit Cost	Total Cost
Aboveground[1]	2,500B[2]	$36.50	$91,250
	5,000B[2]	36.30	181,500
	10,000B[2]	26.25	262,500
	25,000B[2]	18.50	462,500
	50,000B[2]	14.10	705,000
	100,000B[2]	12.00	1,200,000
	250,000B[2]	7.75	1,937,500
Aboveground, w/[3] Floating Pans	2,500B	29.40	73,500
	5,000B	27.65	138,250
	10,000B	25.60	256,000
	25,000B	21.90	547,500
	50,000B	19.00	950,000
	100,000B	13.30	1,330,000
	250,000B	8.65	2,162,500
Underground[4]	1,000G[5]	2.40	2,400
	5,000G	2.25	11,250
	10,000G	2.20	22,000
	20,000G	2.20	44,000
	30,000G	2.20	66,000

[1]Steel tanks, includes foundation dike and exterior coatings.
[2]B = barrels (42 U.S. gallons/barrel)
[3]Steel tanks with floating pans; includes foundation dike, interior epoxy lining and interior coating.
[4]Includes excavation, backfill and manhole; excludes exterior piping and pumping.
[5]G = gallons

Source: EIRS Bulletin 84-02, 26 Oct 84.

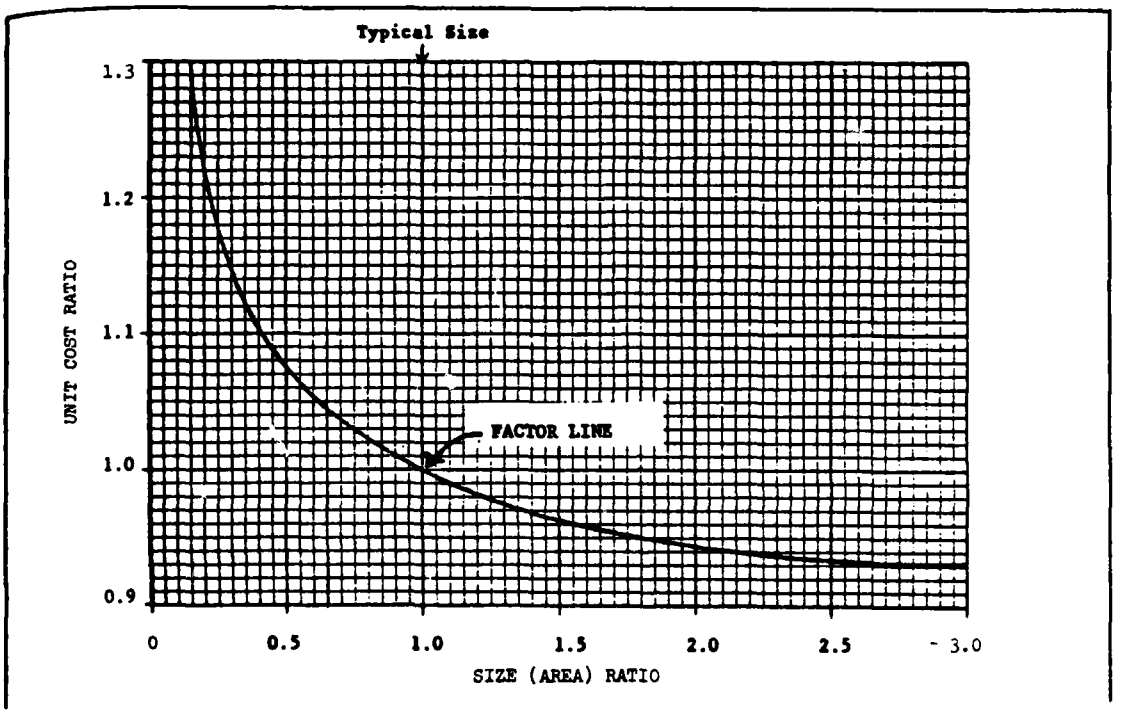
#

TABLE 21-5. PERMANENT BUILDINGS

Type	Typical Size	Cost Per Ft[2] FY 86	Cost Per Ft[2] FY87	Total Cost FY 86 ($000)
Administration Office	25,000	$ 71	$ 74	$1,775[2]
Barracks, Dormitory	115,000	55	57	6,325[2]
Power Building	1,000	360		360[1]
Communications Center	17,000	75		1,275[1]
Sat. Comm. Center	6,000	288	301	1,728[2]
Communications Building	1,300	147		191[1]
Telephone Exchange Bldg	5,700	99		564[1]
Communications/ADP Ctr.	22,000	121		2,662[1]
Data Processing Center	21,000	98	103	2,058[2]

[1]Base year is FY 1984; source 1.
[2]Base year is FY 1986; source 2.

Sources: 1. NAVFAC DM-10, "Cost Engineering Criteria & Cost Data," May 82; DCA, Code 690.
2. OASD(MIL) "Unit Costs for Common Department of Defense Facilities," 10 Aug 84.
3. EIRS Bulletin 84-02, 26 Oct 84.



Adjust the unit cost of the proposed building for size by dividing the gross area by the typical size as shown in table 21-5; locate the quotient on the Size Ratio scale and trace vertically to the Factor Line, then trace horizontally to the Unit Cost Ratio scale. Alternatively, this scaling factor may be calculated using the equation:

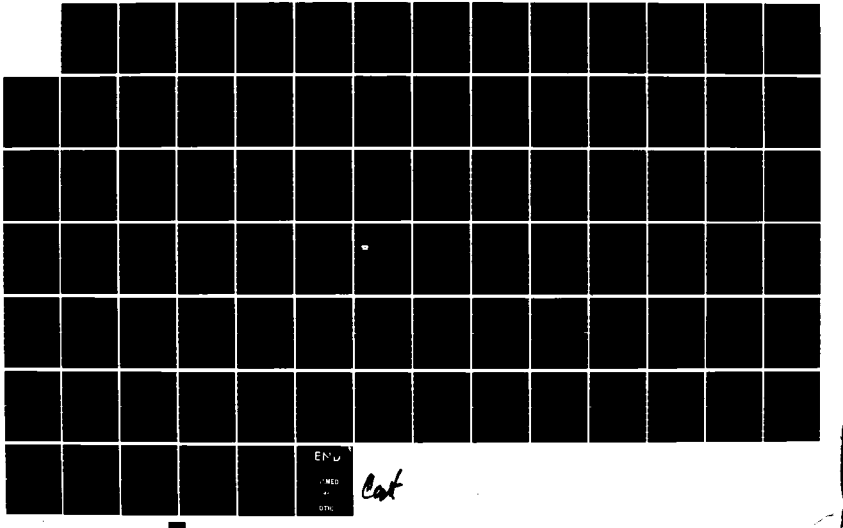
$UC = 6/7 + 1/(7 \times S^{.6})$, with S = size ratio.

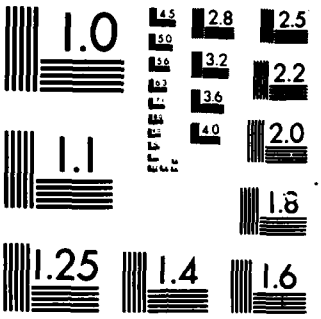
The resultant value is then multiplied by the unit cost in table 21-5 to determine the unit cost for the proposed building.

FIGURE 21-1. SIZE/UNIT COST ADJUSTMENT CHART

AD-A163 319 DEFENSE COMMUNICATIONS AGENCY COST AND PLANNING FACTORS MANUAL CHANGE 2(U) DEFENSE COMMUNICATIONS AGENCY ARLINGTON VA 23 SEP 85 DCA-CIRC-600-60-1-CH-2 2/3

UNCLASSIFIED F/G 17/2 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

4. Assembly, Installation, and Checkout Onsite

a. General. The element comprising assembly, installation, and checkout at the site includes all materials and services required for assembly and installation of mission equipment in the operations and support facility, and complete checkout of the equipment to ensure it is operational.

b. Estimating Procedure.

(1) The assembly, installation, and checkout of equipment onsite may be estimated as a percentage of the total acquisition cost of the prime mission and auxiliary equipment. This factor is shown in table 21-6. Actual costs will vary by type of equipment, where the equipment is being assembled (vendor's plant or onsite), and location of the site (CONUS or overseas, easily accessible or hazardous).

(2) Sufficient data to develop a more specific estimating procedure for this element are not currently available. As additional data are collected, procedures will be developed to update and expand the factor shown.

TABLE 21-6. ASSEMBLY, INSTALLATION, AND CHECKOUT

20% X Prime Mission and Auxiliary Equipment Acquisition Cost
Source: DCA, Code 690.

SECTION D. ANNUAL OPERATING COSTS

CHAPTER 23. MILITARY PERSONNEL RATES

1. General. This chapter provides rates for use in planning, programing, budgeting, accounting, cost analyses, economic analyses, program evaluations, reports (discussed more fully in chapter 42); and for computing reimbursements from other organizations (Federal and non-Federal). It does not include fees for Freedom of Information Act (FOIA) requests (discussed in chapter 42), or civilian personnel rates (discussed in chapter 24).

2. Derivation of Factors. Figure 23-1 graphically shows the composition of the rates in tables 23-2 and 23-3. Under each column heading are the elements included.

a. The DCS composite standard rate is used as the foundation of all rates. It includes the basic pay (at an average longevity increment), retirement accrual (50.7% of basic pay), basic allowance for quarters, miscellaneous expense (an average cost for subsistence, station allowances overseas, uniform and clothing allowances, family separation allowances, separation payments, social security tax, death gratuities, servicemen's life insurance, reenlistment and enlistment bonus, and apprehension of military deserters), permanent change of station (PCS) expense as shown in table 26-7, and incentive and special pay.

b. Medical costs from table 26-6, installation support costs from table 26-1, annual training costs from table 26-4 or 26-5, and per capita temporary duty (TDY) travel costs are added for cost analyses, economic analyses, and program evaluations.

c. Personnel support costs covering base operating support (BOS) personnel and medical (MED) personnel are included for reimbursements (both Government and non-Government) and for cost and economic analyses. These costs are calculated at 6 percent of the standard rate (less PCS from table 26-7) for officers and 18 percent for enlisted personnel.

d. Overhead costs are included for reports at 25 percent of the standard rate (less PCS from table 26-7) to cover supervision, space, and administrative support. If appropriate, prorated costs for supplies, utilities, contract services, supervision, clerical support, and other administrative overhead should be added to cost analyses, economic analyses, and program evaluations. If these costs are required but not available, the 25-percent factor can be used.

e. The factor covering leave and holiday costs is applicable only when the estimated amount of labor is based on time actually worked; i.e., when the reimbursing activity does not otherwise pay for the personnel costs incurred by DoD during nonproductive time, such as leave and holiday periods. This factor is calculated by increasing costs not including PCS by 14 percent. Hourly rates are derived by dividing annual costs by 2080.

<table>
<tr><td>PROGRAM, BUDGET, ACCOUNTING

(ANNUAL)
(1)</td><td>ECONOMIC ANALYSIS

(ANNUAL)
(2)</td><td>REPORTS

(HOURLY)
(3)</td><td>REIMBURSEMENTS FROM ORGANIZATIONS OUTSIDE THE FED. GOV'T.
(HOURLY)
(4)</td><td>REIMBURSEMENTS FROM FEDERAL AGENCIES

(HOURLY)
(5)</td></tr>
<tr><td colspan="3"></td><td colspan="2">LEAVE AND HOLIDAY COSTS</td></tr>
<tr><td colspan="2"></td><td>OVERHEAD</td><td colspan="2"></td></tr>
<tr><td rowspan="2"></td><td>PERS. SUPT.</td><td rowspan="2"></td><td colspan="2">PERSONNEL SUPPORT COSTS</td></tr>
<tr><td>MEDICAL
INSTL. SUPT.
TRAINING
TDY</td><td colspan="2"></td></tr>
<tr><td colspan="5">DCS COMPOSITE STANDARD RATE (BASIC PAY, RETIREMENT ACCRUAL, BASIC ALLOWANCE FOR QUARTERS, MISCELLANEOUS EXPENSE, PERMANENT CHANGE OF STATION, INCENTIVE AND SPECIAL PAY).</td></tr>
</table>

FIGURE 23-1. MILITARY LABOR RATES

f. The references for column 3 are DoDI 5000.22, Guide to Estimating Costs of Information Requirements, 17 October 1974, and DCAI 630-225-2, Management and Control of Information Requirements, 4 October 1976, as amended.

g. The reference for columns 4 and 5 is OASD(MS) Memorandum, subject: Reimbursement Rates for Personnel Services, 17 September 1984.

3. Use of Tables.

a. Table 23-1. This table presents the standard rates for DoD military personnel. These rates are used for planning, programing, budgeting, and accounting. These rates should be used in preparing estimates of fiscal year fund requirements for the military personnel appropriations. They do not, however, reflect the total costs to the Government for military personnel. If service and rank are known, select the rate from the appropriate service column. If the service is unknown, use the column headed "DCS Composite." This rate represents a weighted average of authorized strengths within the Defense Communications System (DCS). The DCS Composite rates are also used as

the total annual rates in the first column in table 23-2. If the rank is unknown, use 0-3 for officers and E-5 for enlisted personnel.

b. Table 23-2. This table presents a compilation of military personnel (DCS composite) rates for most applications. These rates are were developed as shown in table 23-3 and as depicted graphically in figure 23-1. If the rank is unknown, use 0-3 for officers and E-5 for enlisted personnel.

(1) Column 1 is used for programing, budgeting, and accounting when the service is unknown.

(2) Column 2 is used for cost analyses, economic analyses, and program evaluations done under OMB Circular A-94, DoDI 7041.3, or DCAI 600-60-1. Overhead should be added where appropriate to the analysis.

(3) Column 3 is used for estimating the labor costs of reports covered by OMB Circular A-40, DoDI 5000.22, or DCAI 630-225-2. The term "report" refers to data, information, or reports used for specified and authorized Government functions. Column 3 is not used for Freedom of Information Act (FOIA) requests, which always involve a requestor outside the Government, and fees which cover direct costs only (see chapter 42 for FOIA fees, and for a more complete discussion of report cost estimating).

(4) Column 4 gives an hourly rate to calculate reimbursements from organizations outside the Federal Government, and column 5 gives an hourly rate to calculate reimbursements from Federal agencies. In accordance with OSD guidance, these rates are now calculated as in column 4.

(5) Columns 3, 4, and 5 (hourly rates) are to be used when the estimated amount of labor is based on time actually worked; i.e., when the reimbursing activity does not otherwise pay for the personnel costs incurred by DoD during leave and holiday periods. When the amount of labor estimated includes time for leave and holidays; e.g., when an annual approach is used, then the rates in columns 3, 4, or 5 should be adjusted to express the result on an annual basis (by multiplying the hourly rate by 2080) and to eliminate leave and holiday costs (by subtracting 14 percent of the standard rate less PCS). An annual rate may be divided by 4 to determine a quarterly rate or by 12 to determine a monthly rate.

c. Table 23-3. This table gives an example of the calculations used in this chapter, using the grade of O-4 (Major).

d. Table 23-4. This table provides guidelines for estimating the quantities and ranks of military personnel required at various types of DCS sites. To calculate the personnel cost of a typical site, locate the number of each rank of personnel opposite the appropriate type of site and multiply the numbers by the rates in table 23-2.

TABLE 23-1. MILITARY PERSONNEL STANDARD RATES

RANK	ARMY	NAVY	MARINE CORPS	AIR FORCE	DCS COMPOSITE
O-10	$112,855	$117,090	$110,744	$115,243	
O-9	114,649	117,273	113,303	114,761	
O-8	113,313	120,456	112,741	111,134	
O-7	102,227	102,189	102,648	100,409	
O-6	92,626	93,915	91,356	88,753	$ 91,935
O-5	77,068	77,143	75,259	76,602	76,956
O-4	64,146	64,486	62,892	66,003	64,602
O-3	51,419	54,432	53,713	53,423	52,345
O-2	39,744	42,457	43,898	41,339	40,551
O-1	31,472	33,818	31,834	31,735	31,887
W-4	57,720	62,956	59,136		58,767
W-3	48,610	50,980	47,628		49,084
W-2	41,530	47,005	41,839		42,625
W-1	34,512		35,251		34,512
E-9	51,089	52,546	52,658	51,253	51,230
E-8	42,526	44,958	43,240	43,183	42,885
E-7	35,684	38,422	36,018	37,159	36,328
E-6	30,224	32,013	30,216	31,684	30,806
E-5	25,532	26,330	25,839	26,504	25,896
E-4	21,686	22,285	21,814	22,761	22,071
E-3	18,884	18,778	18,044	19,405	19,047
E-2	17,470	17,061	16,366	17,651	17,504
E-1	15,460	15,155	14,642	15,081	15,319

NOTES: CY 1985 RATES.
PCS AND RETIREMENT ACCRUAL ARE INCLUDED.
RATES FOR O-9 AND O-10 REFLECT LIMIT OF $68,700.

SOURCE: MILDEPS; DCA CODE 690, APR 85.

TABLE 23-2. DCA MILITARY LABOR RATES

	ANNUAL RATES		HOURLY RATES		
				REIMBURSEMENTS FROM:	
	PROGRAM, BUDGET, ACCOUNTING	ECONOMIC ANALYSIS	REPORTS	ORGANIZATIONS OUTSIDE FED. GOVT.	REIMBURSEMENTS FROM: FEDERAL AGENCIES
RANK	(1)	(2)	(3)	(4)	(5)
O-6	$ 91,935	$109,410	$ 62.66	$ 53.33	$ 53.33
O-5	76,956	93,532	52.40	44.63	44.63
O-4	64,602	80,437	43.94	37.45	37.45
O-3	52,345	67,445	35.54	30.33	30.33
O-2	40,551	54,943	27.46	23.48	23.48
O-1	31,887	45,759	21.52	18.45	18.45
W-4	58,767	74,252	39.94	34.06	34.06
W-3	49,084	63,988	33.31	28.44	28.44
W-2	42,625	57,142	28.88	24.69	24.69
W-1	34,512	48,542	23.32	19.97	19.97
E-9	51,230	72,350	34.94	33.02	33.02
E-8	42,885	62,503	29.23	27.62	27.62
E-7	36,328	54,765	24.73	23.38	23.38
E-6	30,806	48,249	20.95	19.81	19.81
E-5	25,896	42,456	17.59	16.64	16.64
E-4	22,071	37,942	14.97	14.16	14.16
E-3	19,047	34,374	12.90	12.21	12.21
E-2	17,504	32,553	11.84	11.21	11.21
E-1	15,319	29,975	10.34	9.80	9.80

NOTE: CY 1985 RATES.

SOURCE: TABLE 23-1; DCA CODE 690, MAY 85.

TABLE 23-3. DCA MILITARY LABOR RATES - MAJOR

	ANNUAL RATES		HOURLY RATES		
	PROGRAM, BUDGET, ACCOUNTING	ECONOMIC ANALYSIS	REPORTS	REIMBURSEMENTS FROM ORGANIZATIONS OUTSIDE FED. GOVT.	REIMBURSEMENTS FROM FEDERAL AGENCIES
COST ELEMENT:	(1)	(2)	(3)	(4)	(5)
STANDRD RATE:	$64,602	$64,602	$64,602	$64,602	$64,602
MEDICAL		550			
INSTL. SUPT.		4,000			
TRAINING		6,250			
TDY		1,300			
PERS. SUPT.		3,735		3,735	3,735
OVERHEAD			15,563		
LV/HOLIDAY			11,223	9,567	9,567
ANNUAL RATE	$64,602	$80,437			
HOURLY RATE			$ 43.94	$ 37.45	$ 37.45

NOTE: CY 1985 RATES.

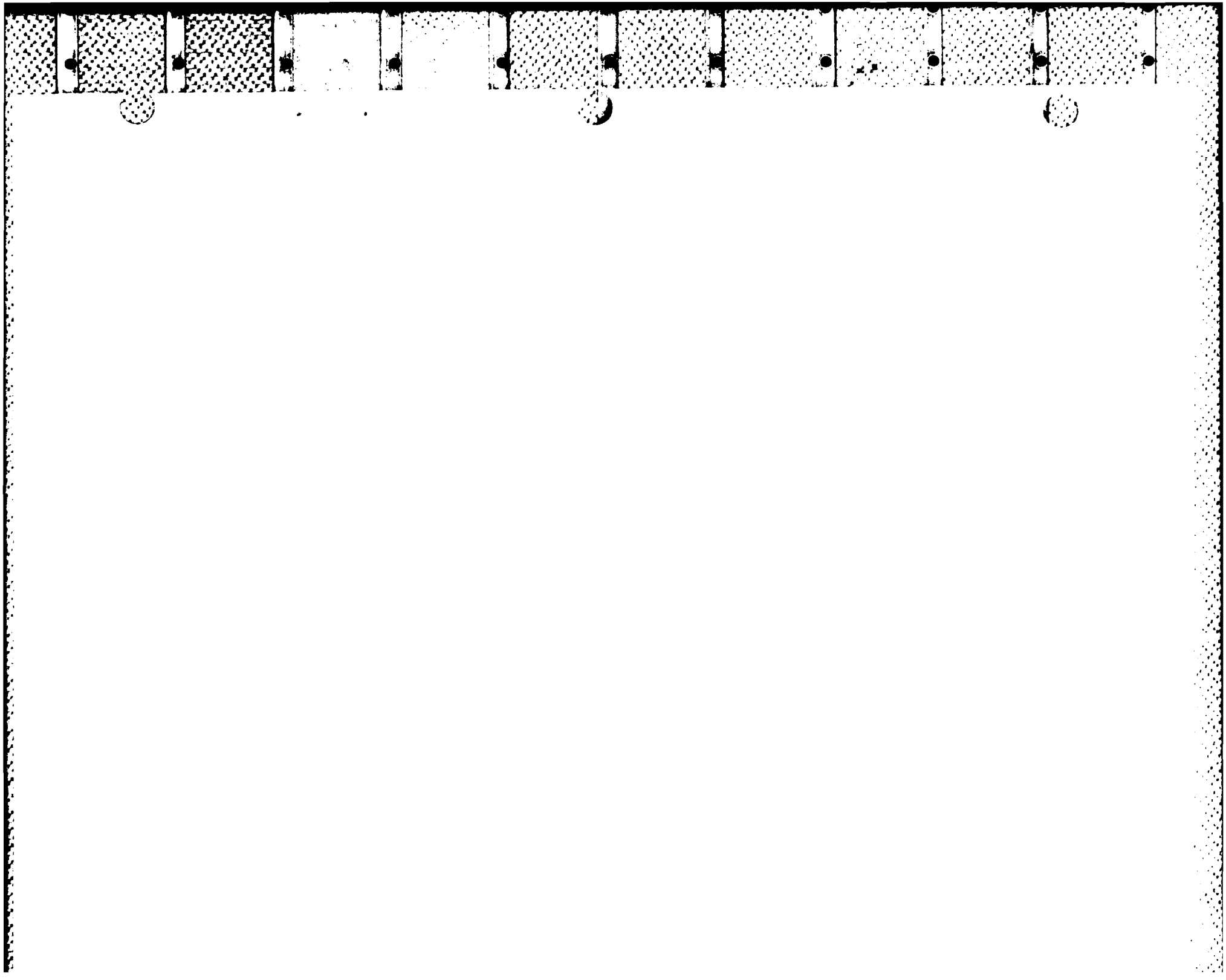
SOURCE: DCA CODE 690, MAY 85.

TABLE 23-4. SITE PERSONNEL GUIDELINES

Site Type	Number and Rank of Personnel						
	E-4	E-5	E-6	E-7	O-2	O-3	Total
LOS Microwave		4	2	1			7
Tropo Scatter		6	2	1			9
High Frequency							
Single-Channel		2					2
Multichannel	3	10	2	1			16
Satellite							
SHF		7	2	1			10
UHF			4				4
Switch							
Voice	3	2	1				6
Secure Voice		2	1				3
Data	3	5	1				9
Data Terminal	9	2					11
Tech Control		3	1				4
Overhead							
Minor Node		2		1	1		4
Major Node	1	3	1	1	1	1	8

NOTES: Based on 12-hour work shifts.
Does not cover housekeeping functions.

Source: Army CEEIA, 1984.



CHAPTER 24. OPERATIONS AND MAINTENANCE

1. Civilian Personnel.

a. Federal Salaried Civilian Labor Rates. This paragraph provides labor rates associated with Federal salaried civilian personnel. It also contains information to assist in costing civilian personnel under special circumstances and in the absence of specific data concerning grade structures.

(1) General. The rates in this paragraph are for use in planning, programing, budgeting, accounting, cost analyses, economic analyses, program evaluations, reports (discussed in chapter 42), and for computing reimbursements from other organizations (Federal and non-Federal). This paragraph does not include fees for Freedom of Information Act (FOIA) requests (discussed in chapter 42), or military personnel rates (discussed in chapter 23).

(2) Derivation of Factors.

(a) The compensation rates in column 1 of tables 24-1 and 24-2 include the payroll rate (using step 5), and fringe benefits. These benefits are calculated as percentages of the payroll rate and consist of funded retirement (7.0 percent), health benefits (3.4 percent), life insurance (0.3 percent), bonuses, awards, and unemployment programs (1.9 percent), and the Government's contribution to Medicare (1.3 percent up to a maximum of $464.10).

(b) The economic analysis rates in column 2 are based on the compensation rates in column 1 increased to cover the full retirement increment (27.9 percent of the payroll rate) and to cover training and temporary duty (TDY) travel costs (total DCA average rate).

(c) Hourly rates for the preparation of reports in accordance with DCAI 630-225-2 are given in column 3. These rates include compensation, the full retirement increment, overhead (a 25.0 percent increase covering supervision, space, and administrative support), and an adjustment for leave and holiday costs (an 18.0 percent increase). These costs are divided by 2087 to give hourly rates.

(d) Hourly rates for reimbursements from organizations outside the Federal Government are given in column 4. These rates include compensation, the full retirement increment, and the adjustment for leave and holiday costs. Costs are divided by 2087 to give hourly rates.

(e) Hourly rates for reimbursements from Federal agencies are given in column 5. These rates are calculated as in column 4, except that the full retirement increment has been excluded in accordance with DoD guidance. Funded retirement (see compensation) is included. Costs are divided by 2087 to give hourly rates.

(3) Figure 24-1.

(a) This pyramidal display graphically shows the composition of the rates in table 24-1. Under each column heading are the elements included.

(b) Civilian compensation is used for the foundation of all rates.

(c) The full retirement increment is added to compensation for cost analyses, economic analyses, program evaluations, reports, and reimbursements from organizations outside the Federal Government. The full retirement increment is not added for reimbursements from Federal agencies, but funded retirement (see compensation) is included.

(d) Training and TDY costs are added only for cost analyses, economic analyses, and program evaluations.

(e) Overhead costs are included only for reports.

(f) The factor covering the accrual of leave and holiday costs is applicable only when the estimated amount of labor is based on time actually worked; i.e., when the reimbursing activity does not otherwise pay for the personnel costs incurred by DoD during nonproductive time, such as leave and holiday periods. Hourly rates for reports and reimbursements (both

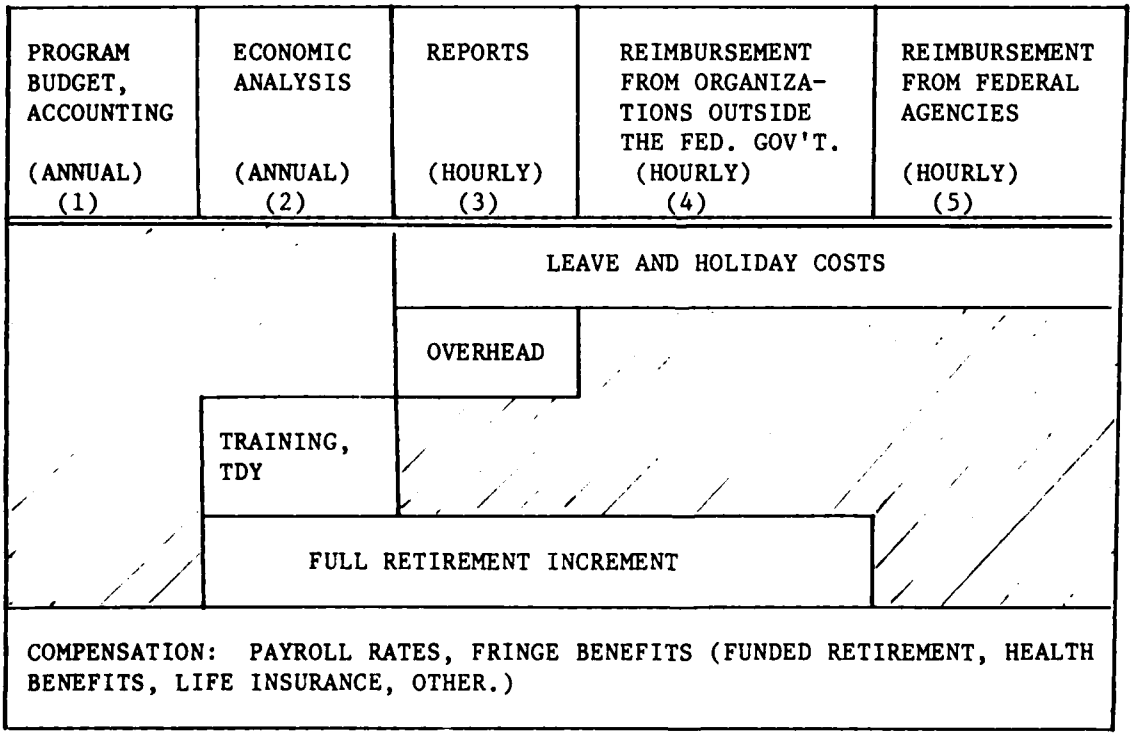


FIGURE 24-1. CIVILIAN RATES

Government and non-Government); such as those in tables 24-1 and 24-2, include leave and holiday costs. When the estimated amount of labor includes time for leave and holidays; e.g., when an annual approach is used, the leave and holiday accrual factor should not be included.

(g) The references for column 3 are DoDI 5000.22, Guide to Estimating Costs of Information Requirements, 17 October 1974, and DCAI 630-225-2, Management and Control of Information Requirements, 4 October 1976, as amended.

(h) The reference for columns 4 and 5 is OASD(C) Memorandum, subject: Reimbursement Rates for Personnel Services, 24 September 1980.

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TABLE 24-1. DCA CIVILIAN LABOR RATES

	ANNUAL RATES		HOURLY RATES		
	PROGRAM, BUDGET, ACCOUNTING	ECONOMIC ANALYSIS	REPORTS	REIMBURSEMENTS FROM ORGANIZATIONS OUTSIDE FED. GOVT.	REIMBURSEMENTS FROM FEDERAL AGENCIES
GRADE:	(1)	(2)	(3)	(4)	(5)
SES	$ 77,820	$ 98,777			
15	67,157	85,472	$ 59.14	$ 47.31	$ 37.97
14	57,163	73,001	50.33	40.26	32.32
13	48,444	62,122	42.64	34.11	27.39
12	40,814	52,602	35.91	28.73	23.08
11	34,052	44,183	29.96	23.97	19.25
10	30,993	40,374	27.27	21.82	17.52
9	28,147	36,831	24.77	19.81	15.91
8	25,481	33,513	22.42	17.94	14.41
7	23,007	30,433	20.24	16.19	13.01
6	20,707	27,569	18.22	14.58	11.71
5	18,577	24,918	16.35	13.08	10.50
4	16,604	22,461	14.61	11.69	9.39
3	14,790	20,203	13.01	10.41	8.36
2	13,122	18,126	11.55	9.24	7.42
1	12,052	16,795	10.60	8.48	6.81

NOTE: CY 1986 RATES; SES CALCULATED AT $68,700.

SOURCE: DCA, CODE 690, OCTOBER 1985.

TABLE 24-2. DCA CIVILIAN LABOR RATES - GS-13

	ANNUAL RATES		HOURLY RATES		
	PROGRAM, BUDGET, ACCOUNTING	ECONOMIC ANALYSIS	REPORTS	REIMBURSEMENTS FROM ORGANIZATIONS OUTSIDE FED. GOVT.	REIMBURSEMENTS FROM FEDERAL AGENCIES
COST ELEMENT:	(1)	(2)	(3)	(4)	(5)
PAYROLL RATE:	$42,611	$42,611	$42,611	$42,611	$42,611
BENEFITS	5,833	5,833	5,833	5,833	5,833
FULL RET. INCREMENT		11,888	11,888	11,888	
TRAINING		490			
TDY		1,300			
OVERHEAD			15,083		
LV./HOLIDAY			13,575	10,860	8,720
ANNUAL RATE	$48,444	$62,123			
HOURLY RATE			$ 42.64	$ 34.11	$ 27.39

NOTES : CY 1986 RATES. SEE PARAGRAPH 1a(4)(d) FOR COSTS THAT ARE POTENTIALLY ADDITIVE FOR ECONOMIC ANALYSES.

SOURCE: DCA, CODE 690, OCTOBER 1985.

TABLE 24-6. TEMPORARY DUTY TRAVEL COSTS

	CONUS	Overseas
POV Mileage (Driver only)	$0.205/mi	-
Car Rental (Compact)	$22-27/day	$40/day
Per Diem[1]		
Major Cities	$56-75/day	$50-130/day
Other	$35/day	$50/day
Miscellaneous Expenses	$20/round trip	$50/round trip
Air Fare from or to Washington, DC		
MAC travel to Europe	$400	
Commercial Air (Category Z)		
Africa	780	
Alaska	300	
Caribbean	155	
CONUS cities	29-279	
Europe	415	
Far East	830	
Hawaii	300	
Near East	590	
United Kingdom/Belgium	345	

[1]Reimbursement is reduced 50 percent when Government quarters are available and 14 percent when Government mess is available and increased by the amount of charges.

Source: DCA Travel Office, May 84; USAF MAC Airlift Service Industrial Fund Rates, 28 Jul 83; DCA Code 690.

c. Civilian Personnel PCS Cost.

(1) General. Civilian PCS costs are incurred when individuals and their authorized dependents are permanently moved. U.S. civilians so assigned are authorized to move or store their household goods and personal effects, and to receive transportation, per diem, and mileage for themselves and authorized dependents for the trip to the new location.

(2) Derivation of Factor. The factor in table 24-7 covers shipment and temporary storage of household goods (HHG), transit living quarters, a house-hunting trip, real estate expenses, miscellaneous expenses, and PCS move travel and per diem.

(3) Use of Table 24-7. Determine the estimated number of civilian personnel and multiply by the appropriate factor from table 24-7.

TABLE 24-7. CIVILIAN PERSONNEL PCS COST

Cost Per Civilian Move	$30,000

NOTE: Base year is FY 1984.

Source: DCA, Code 690, Apr 85.

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3. Transportation of Things.

a. General. Transportation of things involves movement of supplies, equipment, tools, and material to or from the base or construction site. The factors presented in this paragraph are for relocation of material when considerable distance between areas is involved. When specifics as to size and weight are not available, transportation costs can be computed as a percentage of equipment cost. (See tables 24-8 and 9.) When more specific details are available to the cost estimator, transportation costs can be determined from the rate tables for air, water, and land transportation. (See tables 24-10, 11, and 12.)

b. Derivation of Factors.

(1) Transportation factors as a percentage of equipment costs are based on prior year cost experience for Department of Defense material shipped to or from overseas on a worldwide basis.

(2) Aircraft cargo rates were derived from Airlift Service Industrial Fund (ASIF) rates. Airlift procured through the ASIF includes commercial service contracted by the Military Airlift Command.

(3) Ocean freight rates are based on port-handling charges and ocean freight transportation costs from east or west coast port terminals using a minimum of 40 cubic feet per measurement ton. CONUS and overseas port-handling costs are included.

(4) Vehicle-operating costs were developed from the military cost accounting system for motor vehicles.

c. Use of Tables.

(1) Tables 24-8 and 9, Transportation. In cases where the planner has insufficient information to base an estimate upon the equipment size and weight, relatively accurate overall estimates may be obtained by using factors representing a percentage of the equipment costs. This percentage covers the costs associated with forwarding equipment to the U.S. port, port-loading charges, costs for ocean transportation to the foreign port, and unloading charges (forwarding to final destination not included).

(a) Costing Considerations.

1. Administrative costs, such as general overhead expense and associated contractor personnel costs, are not included. See table 24-9 for contractor-operated base cost factors pertinent to processing and handling equipment.

2. The parcel post factor should be used for shipment of data or small parts.

TABLE 24-11. OCEAN FREIGHT RATES

	General Cargo	Military Vans	Wheeled Vehicles
East Coast to:			
Panama Lant	$ 67	$42	$46
Europe	81	52	56
British Isles	79	51	55
East Mediterranean	88	58	62
South & East Africa	97	65	69
West Coast, S. America	78	50	54
East Coast, S. America	87	57	61
Rhine River	82	53	57
West Coast to:			
Panama Lant	86	51	57
Europe	108	68	74
British Isles	107	67	73
East Alaska	73	41	48
West Alaska	77	45	51
Hawaiian Islands	80	45	51
Taiwan	98	60	67
Philippine Islands	102	63	69
Thailand	108	67	74
South Pacific	89	53	60
West Coast, S. America	91	55	61
East Coast, S. America	106	66	73
Vietnam	112	71	77
Ryuku Islands	98	60	67
Korea	96	59	65
Japan	95	58	64

NOTES: These measurement-ton rates include transportation, port handling, and documentation cost for containers already packed. If sea vans are stuffed (packed) at port, add $18.88 per ton at east coast or $11.00 per ton at west coast.

Source: Military Sealift Command Billing Rates, COMSCINST 7600.3F, dated 15 July 75; MTMC Port Handling Billing Rates, DA Pamphlet 55-3, dated Sep 78; DCA, Code 690, as of 4 Nov 75.

TABLE 24-12. VEHICLE OPERATING AND MAINTENANCE COSTS

Type of Vehicle	Average Annual Mileage Per Vehicle	Average Miles Per Gallon of Fuel	Total O&M Cost Per Mile[1] (CONUS)	Monthly GSA Lease Rate
Sedan				
Compact	8,200 mi.	19.2 mpg.	$0.25	
Standard	6,800	14.7	.37	
Station Wagon				
Compact	11,000	19.3	.24	$330
Open Road	8,300	19.2	.26	
Ambulance	3,900	10.1	.62	
Bus	11,400	8.2	.66	
Truck				
Compact	9,700	18.8	.18	
Up to 4.25 Tons				
4 X 2	9,600	11.2	.38	375
4 X 4	10,100	10.3	.43	
6.25-12 Tons	5,900	10.5	.46	
Over 12 Tons	6,500	8.0	.61	

NOTES: Base Year is FY 1985.
[1]Excludes vehicle operator salary.

Source: AFR 173-13, table 2-11, 1 Feb 85; GSA.

(4) Table 24-12, Vehicle Operating and Maintenance Costs. An estimate of the average annual operating and maintenance costs (except for costs of the vehicle operator) of Government-owned and Government-operated vehicles can be obtained from the following table by multiplying the number of vehicles by the estimated mileage (or average mileage) for each vehicle of a similar type, then multiplying this product by the appropriate O&M cost.

4. Utilities and POL.

a. General. The annual recurring costs of petroleum, oils, and lubricants (POL), heat, light, and other related utility services, except transportation and communications services (post, camp, or station communications), are discussed herein. The use of POL products is addressed in terms of operating power units for generators and necessary heating of buildings. Vehicle fuel requirements are addressed in paragraph 3.

(1) Cost estimates should generally be based upon the site's operating 24 hours a day, 7 days a week (8760 hours for a 365-day year).

(2) The cost of number two fuel oil or grade 2-D diesel fuel contains the cost for delivery of fuel, lubricating oil consumed by the diesel engine per gallon of fuel, and transportation costs. Sites remote from military bases or populated areas may incur additional trucking costs.

(3) Use the price for number two fuel oil or grade 2-D diesel oil for estimating both power and heating costs when another type of fuel is not specified.

(4) Factors apply to locations in similar latitudes or weather conditions. Using the standard temperatures of 55 degrees for unoccupied buildings and 65 degrees for occupied buildings, one can determine from weather data the number of degrees below the standard in terms of degree-days.

b. Electricity.

(1) Fuel Costs for Auxiliary Power-Generating Equipment.

(a) General.

1. Fuel consumption requirements for communications power-generating equipment are based upon the kilowatt hours (kWh) of power required to operate each station, terminal, or relay site, plus the fuel necessary to test and exercise backup or no-break power units.

2. Commercial electricity is the primary source of DCS power; however, backup power other than commercial is normally required at the sites. The operating hours of generator sets are dependent upon the reliability of commercial power available during emergency conditions. (See chapter 14.)

(b) Estimating Procedure.

1. Determine the kW power requirement by computing the kW requirement of the equipment and a kW factor to support necessary utilities. (Utilities are generally considered an operational load related to the number of authorized personnel and the climatic conditions at the site.)

2. Determine the product of the consumption factor for fuel, the required kWh factor, the price of fuel (including delivery), and the annual operating hours for the diesel electric sets to obtain annual operating costs for fuel. Expressed as an equation:

$$\text{Annual fuel costs} = \frac{H \times C \times K}{F}$$

with:

H = Number of operating hours per year.
C = Cost of the fuel being used.
K = Kilowatt power requirement.
F = Number of kWh produced by each gallon of fuel.

(2) Commercial Electricity Costs. These costs are estimated using the local prevailing rate per kWh. It is necessary to coordinate the use of commercial electricity with emergency requirements, such as battery banks or fuel for standby generators. The cost of fuel to operate generators is equal to or slightly less than the price for commercial electricity costs, dependent upon the fuel consumption factor. See table 24-13.

(3) Example 1. A manned LOS microwave terminal (10 men) in CONUS with a commercial primary power source requires a class B power plant consisting of two 30-kW generators and an auxiliary class D static system to ensure uninterruptible power. Table 24-13 factors are applicable.

(a) Commercial Prime Power Requirements. See chapter 14.

	Average kW Load
Operational load (equipment).	25
Nonoperational load (personnel) 10 X .5 =	5
Total	30

(b) Auxiliary Power Requirements.

	Hours
Two 30-kW generators, each exercised for 2 hours every 2 weeks.	104
Estimate for emergency operations per year (due to weather, etc.).	296
Annual hours	400

(c) Annual Utilities Cost.

	Cost
Prime: 8760 hr X 30 kW X $0.048/kWh	$12,610
Auxiliary: $\frac{400 \text{ hr X } 30 \text{ kW X } \$1.03/\text{gal}}{12 \text{ kWh/gal}}$	1,030
Annual cost	$13,640

(4) Example 2. An LOS microwave site without commercial power requires a class A power plant consisting of three 30-kW generators
(prime, backup, and scheduled maintenance) operating 8760 hours per year plus an auxiliary class D static system to ensure uninterruptible power. The average load is 25 kW. Factors appear in table 24-13.

Annual utilities cost: $\frac{8760 \text{ hr} \times 25 \text{ kW} \times \$0.95/\text{gal}}{12 \text{ kWh/gal}} = \$17,300$

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TABLE 24-13. UTILITIES AND POL

Item	Factor
Fuel Oil (grade DF-2)	
Consumption	12 kWh/gal
Cost (delivered)	$ 0.95/gal
Commercial Electricity Cost (large CONUS base)	
Summer	$ 0.058/kWh
Winter	.040/kWh
Water	
Consumption	100 gal/day/person
Cost (including sewage)	$0.0013/gal

NOTE: Base Year is FY 1985.

Source: DFSC Price Bulletin; Andrews AFB; DCA, Code 690, May 85.

c. Heating.

(1) General.

(a) To estimate operating fuel requirements for heating equipment, it is necessary to consider type of construction, season, zone, and other climatic factors, cubic footage of area to be heated, gross loss of heat, equipment and lighting heat input, and efficiency ratings of heating equipment.

(b) Basic guidelines used by civil engineers in computing heating cost estimates are as follows:

1. The building heating equipment is designed to maintain 75 degrees indoor temperature during daily operating conditions at outdoor winter design conditions established for the geographical area. In addition, the heating system should have a minimum capacity to maintain 50 degrees indoor temperature without operation of communications equipment or lights at outdoor winter design conditions. Heating equipment generally operates at 80-percent efficiency, and may use one or more fuels.

2. When diesel generators are in use, heating equipment normally will use the same type of fuel; i.e., number two fuel oil or grade 2-D diesel fuel. British thermal unit (Btu) output increases in proportion to the weight of the fuel.

(2) Use of Table. To estimate costs where only general seasonal, climatic, and geographical factors are known, assume the building will be designed to meet the minimum temperature standard (50 to 65 degrees) for the building area where heating is absolutely essential. Consider the location required (e.g., mountainous or windy) and multiply the cubic footage of the building to be heated by the appropriate factor from table 24-14 for gallons per cubic foot of space. Utilize the 55-degree-day table for buildings not normally occupied and the 65-degree-day table for occupied buildings. Adequate heat to maintain 65 degrees plus gains from equipment and lights will provide necessary working and living conditions for communications maintenance and operational personnel.

(3) Estimating Procedures.

(a) Multiply cubic feet of building space by the appropriate factors from table 24-14.

(b) Multiply total gallons of heating fuel obtained by the cost factor in table 24-13 for number two fuel oil to obtain the annual cost for heating.

(4) Example. Heating costs are to be estimated for a remote LOS microwave site located within 60 miles of Olathe, Kansas. The building complex will be insulated, with a ceiling height of 10 feet, and will contain barracks, mess, recreation, and support facilities for 15 communications and 6 support personnel (military) in addition to operational communications equipment. Required square footage is shown below.

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TABLE 24-18. CONTRACTOR SALARIES FOR SCIENTIFIC, ENGINEERING, AND TECHNICAL SUPPORT

		Total Cost	
	Monthly Salary	ILC Factor = 1.25	ILC Factor = 1.50
Engineers			
Senior Engineers	$4,799	$13,778	$15,309
Midlevel Engineers	4,148	11,909	13,232
Junior Engineers	3,529	10,132	11,258
System Analysts			
Senior Analyst	4,111	11,802	13,114
Midlevel Analyst	2,932	8,418	9,353
Programmers			
Senior Programmers	2,947	8,461	9,401
Junior Programmers	2,099	6,026	6,696
Engineering Technicians			
Senior Technicians	2,343	6,727	7,474
Junior Technicians	1,695	4,866	5,407

NOTE: Total Cost uses G&A rate of 16% and Fee rate of 10%.

Source: 1984 NSPE Income and Salary Survey and 1984 BLS Survey, validated by DCA contract experience, both updated to FY 1986.

(b) Indirect Labor Charges (ILC) include all labor costs chargeable to the contract other than the salaries of the professional, technical, and scientific persons included under DLC above. ILC covers the salaries of the administrative, secretarial, clerical, and graphics support personnel. ILC also covers the employee benefits, social security, workmen's compensation, and an amount for nonproductive time for all persons charged to this contract. An analysis of recent DCA contracts showed that ILC, using this definition, ranged from 87 percent to 211 percent of DLC with an average value of 150 percent. Table 24-19 shows how the ILC rate varied for different categories of tasks. For planning purposes, without better information such as prior contracts for very similar work, use table 24-19 if the task falls into one of the categories of the table. Use an ILC factor of 1.25 for Senior Engineers and Analysts and otherwise use the formula:

$$ILC = 1.5 \times DLC$$

(c) Other Direct Charges (ODC) cover travel (including transportation, per diem, and rental cars), material, equipment, ADP, consulting, subcontracts, and other items. These items can only be identified and priced after development of a more specific knowledge of the required tasks. Many of these items can be priced by using readily available sources (e.g., airline fares, equipment catalog prices, rental car schedules). ADP equipment prices can be found in Auerbach Computer Technology reports, or other reference sources.

TABLE 24-19. ILC FACTORS FOR SCIENTIFIC, ENGINEERING, AND TECHNICAL SUPPORT CONTRACTS

Category	ILC Factor
Management Analysis, Math Modeling, Operations Research	1.25 - 1.50
Test Design and Implementation, Technical Assistance, Computer Programing	
Engineering Support, Data Collection, Update Previous Studies	.90 - 1.25

Source: Code 680 study of DCA contracts, 1985.

(6) Federal Contract Research Centers. There are six Federal Contract Research Centers (FCRC's), four of which are used by DCA as shown in table 24-20. These are nonprofit organizations primarily engaged in providing independent specialized technical and scientific support to DoD. FCRC's charge a fixed fee per TSM (table 24-20). This is a loaded fee that includes ILC, G&A, and Fee discussed previously.

(a) To prepare an independent estimate for an FCRC contract effort, the types and amounts of effort required to perform the tasks are identified in the SOW as described in paragraph (1)(c) above.

(b) Multiply the total number of TSM required by the cost per TSM from table 24-20.

(c) Use the Independent Cost Estimate Worksheet to complete the estimate. Do not, however, complete section 2 (Indirect Labor Charges), section 4 (G&A), or 5 (Fee), as the costs for these items are included in table 24-20.

(d) Time phasing of planning estimates for FCRC's is accomplished as described in paragraph (4).

TABLE 24-20. FEDERAL CONTRACT RESEARCH CENTERS

FCRC	Fee per TSM
Institute for Defense Analysis (IDA)	$12,500
Lincoln Labs	13,700
MITRE	
CONUS	10,900
Europe	16,700
Pacific	14,500
AEROSPACE	12,900

NOTE: Base Year is FY 1985.

Source: Code 620, Mar 85.

6. Security Clearances.

a. General. The U.S. Government incurs expenses for investigations of all personnel who require access to information which has been classified in the interests of national security. Investigations of employees of, and contractors for, the military departments and defense agencies are conducted by the Defense Investigative Service (DIS).

b. Derivation of Costs. Table 24-21 presents average costs for Special Background Investigations (SBI), Background Investigations (BI), and Periodic Reinvestigations (PR) on DCA personnel. Included are costs of "full field" DIS investigations and National Agency Checks, as well as Security Division costs associated with converting investigations into clearances. Periodic reinvestigations are updates conducted on individuals at 5-year intervals. To determine a recurring annual cost, divide the cost indicated in the table by 5. When an overseas check is required for military personnel, it is conducted by the applicable military department.

TABLE 24-21. SECURITY CLEARANCE COSTS

Item	Cost
Special Background Investigation	$691
Background Investigation	463
Periodic Reinvestigation	463
Overseas Check	50

Source: DIS, DCA Code 330, Mar 85.

(4) Example. LOS total equipment costing $857,000 requires contractual support available from a host base.

$857,000 X .003 = $2,571 annual cost

d. Contractor-Operated Base Markups.

(1) General. A review of current contracts revealed a wide range of contractual support costs. It is necessary to apply the personnel costs of the local country as shown by table 24-5 to the technical and clerical personnel costs of the U.S. contractor. Costs in table 24-15 for engineering and key personnel of the contractor already incorporate these support costs.

(2) Use of Table. Table 24-22 contains cost factors and instructions as to application of the markup to cost estimates developed in accordance with other parts of this Circular; e.g., cost markup on salaries or material purchase prices. These factors should be used only when the salaries of personnel or material purchase prices exclude overhead and miscellaneous support costs.

(3) Estimating Procedure.

(a) Consider the type of personnel trained to operate the transmission media as well as the climatic factors, the geographical area, and the political situation of the foreign country. When adequate personnel are available from a nearby city, the amount of required personnel housing and other support will decrease. Conversely, if the base is to be operated in a remote desert, all personnel support must be included in the base facility complex. The estimate must incorporate the contractor's cost and overhead and profit. Contractor costs are subject to, and directly affected by, the foreign country's political situation and customs, a factor difficult to evaluate but necessary to consider.

(b) Use the basic factors and block diagrams available in this Circular for estimating equipment, supplies, spare parts, other material, transportation, etc., anticipated to be furnished by contract. Separately identify the subtotals of the various categories of cost; apply the overhead factors to the categories; compute the direct costs which include personnel overhead; apply the additional factor for overhead, taxes and profits; and total. Determine the appropriate totals and apply the factors in table 24-22.

TABLE 24-22. MISCELLANEOUS O&M FACTORS

Item	Mark-up Percentage
Annual Costs	
Maintenance and Acquisition of Buildings	5 %
Supplies and Equipment	3
Military Base Contractual Services (excludes DECCO and contractor-operated base)	
Host-Tenant Support Available	0.3
Host-Tenant Support Not Available	1
Contractor-Operated Base Markups	
Personnel Overhead: Increase Salaries for Civilians (U.S. or foreign)	25
Processing and Handling of Materials: Increase Total Purchase Price	6
Other Overhead: Increase Total for Direct Cost Plus Above Percentage Markups	5
U.S. Taxes and Profit: Increase All Costs and Prior Markups	10

Source: DCA, Code 690, current as of Mar 85.

CHAPTER 26. OPERATING SUPPORT

1. General. To facilitate complete coverage of applicable costs, this chapter highlights program or systems costs generally excluded from planning, programing, and budget estimates. Operating support costs require an expenditure of Government resources either directly or, as is more often the case, in an indirect manner not easily associated with individual projects. Funding for these items, therefore, is generally provided for by overall military department requirements rather than by the accumulation of individual project cost estimates in the budget. These hidden costs are required to support all communications installations regardless of the cognizant military department providing the support or funding the system. Therefore, these costs should be considered in the conduct of cost-benefit and cost-effectiveness studies, although they are not generally included in formal program budget estimates # for individual projects.

a. Operating support costs are generally associated with personnel when the site is located on or adjacent to a military installation. The support provided includes housing, recreational, welfare, and medical facilities.

b. The military departments provide supply and equipment support, depot maintenance of equipment, replacement training, and costs of moving military personnel, their dependents and household goods (military PCS travel).

c. U.S. civilians employed by the U.S. Government in overseas locations are provided additional support because of their status as representatives of # the United States in a foreign land. This support may include medical and dental care and hospitalization; Government transportation and housing; recreational, welfare, mess, and other related facilities; and schools for dependents.

d. This chapter is organized to highlight estimating procedures for five major operating support costs.

(1) Base operations.

(2) Depot maintenance.

(3) Recruiting, accession travel, basic training,and communications specialty training.

(4) Medical facilities.

(5) Military PCS travel.

2. Base Operations.

a. Installation Support (Non-Pay). Installation support costs are incurred by the host organization or command in providing post, camp, station, or base-level support to communications sites or stations. This support includes the variable nonpay cost of acquisition, construction, maintenance, and operation of real property facilities; the peculiar support equipment, necessary facilities, and associated marginal costs specifically identified with base telephone systems, nontactical radio systems, wire communication services, intrabase radio systems, and base-level commercial communications requirements; and costs for supply, travel, ADP support, and rent associated with comptroller, consolidated base personnel office, audiovisual services, social actions, judge advocate, command section, fuels management, and other base support functions. It does not include the cost of Base Operating Support (BOS) personnel supporting the operation of the installation and the tenant organizations stationed there. This cost is covered under "personnel support" (see chapter 23).

b. Education of Dependent Children. Table 26-2 provides the average worldwide tuition for children at DoD dependent schools. This factor represents the average cost incurred by the responsible military department for providing service-operated or contract schools for dependent children accompanying DoD personnel.

c. Use of Tables.

(1) Table 26-1. The current cost-per-authorization factors for estimating installation support for communications programs are presented in table 26-1. When the supporting military department is not known, or the program is a joint military function, use the factor in the column "DCS Composite."

(2) Table 26-2. The annual cost for education of civilian and military dependent children is used for costing civilian and military personnel in system studies, economic analyses, and comparisons of commercial or industrial activities. When the actual number of school age children is unknown, use an estimate of two school-age children for each authorized U.S. civilian position above GS-7 and for each authorized military position above the ranks of O-3, W-1, and E-5, and one school-age child for all other civilians and all other military above the rank of E-2.

d. Estimating Procedure.

(1) To estimate the installation support required by a proposed communications site or station, multiply the total number of officers and enlisted personnel authorized for the organization by the appropriate cost-per-authorization factor, then escalate the cost to the appropriate year in accordance with chapter 38.

TABLE 26-1. ANNUAL INSTALLATIONS SUPPORT COST

Location	Cost Per Military Authorization			
	Army	Navy	Air Force	DCS Composite
Worldwide	$3,450	Unknown	$5,030	$4,000
CONUS	2,400		4,700	
OCONUS			6,240	
Europe	4,150			
Hawaii	3,550			
Alaska	4,600			
Korea	6,150			
Panama	4,200			

NOTE: Base Year is FY 1985. Costs cover nonpay installation support only.

Source: AFR 173-13, figure 7-2, 1 Feb 85; "US Army OMA and MPA Cost Factors Handbook," Exhibit III-10, 28 Dec 84; DCA, Code 690.

Example 1: Authorization is for 30 officers and enlisted personnel at an overseas location. Support is to be provided by the Air Force in FY 1985. The O&M cost in FY 1985 dollars is calculated as follows:

30 X $6,240 = $187,200

Example 2: Authorization is for one officer and 20 enlisted personnel in FY 1985. Service and location are unknown.

21 X $4,000 = $84,000

(2) Determine whether dependents are authorized at the site or station. Use the product of the geographical area factor, the number of dependent children, and the escalation factor from chapter 38. For example:

Grade/Rank	Number Authorized	Total Dependent Children
GS-13	1	2
GS-10	1	2
GS-7	1	1
O-3	1	1
E-2	1	0
Total	5	6

When incremental costing is required, multiply:

6 dependents x $4,500 per student = $27,000 in FY85 dollars.

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TABLE 26-2. EDUCATION OF DEPENDENT CHILDREN

	Annual Tuition Per Student
DoD Worldwide Average	$4,500

NOTE: Base Year is FY 1985.

Source: DoD Dependent Schools, Apr 85.

3. Depot Maintenance.

a. General. The military department operating the communications electronics maintenance depots incurs the cost for the repair, modification, testing, storage, and rehabilitation of communications equipment. Neither DCA nor the commands charged with operating and maintaining the C/E equipment are generally required to account or budget for these costs; however, it is important, even if these costs are excluded from budget estimates, that they be specifically considered in cost-benefit and cost-effectiveness studies for communications projects. The maintenance costs of work performed at depots are charged to program VII in the Five Year Defense Program. Depot costs are not reflected in the prices of the replacement of replenishment spares or repair parts.

b. Derivation of Factors. The factors presented reflect the fact that the environment in which the equipment is operated plays a major role in the frequency and magnitude of depot repair. Transportable communications equipment is subject to combat damage, movement stress, and environmental conditions such as salt air, dust, and dampness. DCS equipment, however, is generally installed in permanent facilities under controlled environmental conditions; consequently, the majority of depot maintenance for DCS communications equipment does not involve major repair of hardware items. Instead, it generally consists of replacement of moving parts and modules. This environment results in a lower cost factor than that for equipment operated under field conditions. Cost factors for specified items of communications equipment for which overhaul data were available from Army depots were derived by converting unit costs for their repair to an annual basis.

c. Use of Table 26-3. Multiply the acquisition cost of the prime mission, auxiliary, and test equipment by the appropriate factor in the table to obtain annual recurring depot maintenance costs. For example, assume that the DCS communications prime mission, auxiliary, and support equipment cost for a fixed site system is $2 million.

$2,000,000 X .005 = $10,000 annual depot maintenance.

TABLE 26-3. DEPOT MAINTENANCE COST FACTORS

Equipment Type	Annual Cost Factor
DCS Fixed Site	0.005
Transportable	0.025

Source: DCA, Code 690, 1 Oct 75.

4. Recruitment, Basic Training, and Specialty Training.

a. General. The basic methodology and data for estimating the training and associated costs incurred in training recruits to ensure the presence of trained technicians over a period of years is provided herein. Costs are displayed for individual training and are then converted to an annual cost to account for personnel losses that will be incurred over a period of time.

(1) The costs shown in tables 26-4 and 26-5 provide for the following:

(a) Force maintenance costs to recruit, transport, indoctrinate, examine, and clothe recruits.

(b) Personnel, equipment, and facility costs associated with the operations of basic and technical training centers.

(c) Transportation and salaries for students attending schools.

(d) Education of officers at service academies, college level ROTC, and officers training schools.

(2) Costs excluded from those shown in tables 26-4 and 26-5 are:

(a) Costs of contractor-conducted training procured as part of a contract for equipment. Such training is considered an investment cost and will be estimated and priced separately in accordance with instructions contained in chapter 16.

(b) Costs have not been adjusted for the small number of recruits who will, by virtue of previous military service or civilian education, perform in a technical speciality without further training.

(3) The costs contained herein are a composite of funding for several budget appropriations; therefore, they should not be used to estimate the annual requirements for any one budget appropriation or classification.

b. Computation of Annual Training Costs.

(1) The annual training costs are the product of the training costs and the annual attrition factor.

(2) The annual attrition rate is derived from the retention rate (1 - retention rate = attrition rate). Total losses for a period are computed and added to the initial requirements to obtain total training requirements (1 + losses = total requirements). This quantity is then divided by the number of years for which losses were determined. The decimal fraction resulting from the conversion of this total to a percentage is the Annual Attrition Factor. Expressed mathematically:

$$\text{Annual Attrition Factor} = \frac{1+(1-RF_1)+(1-RF_2)+(1-RF_n)}{100Y}$$

Where: RF_1, RF_2, and RF_n = Retention Factors for a term or period of years

y = The total number of years used to compute RF_1, RF_2, and RF_n

100 = Constant used to convert results to a percentage

c. Use of Tables:

(1) Table 26-4 contains the training costs and annual attrition factors for specialties employed within the DCS. In estimating the training costs for a facility, the staffing, if not given, must be estimated or extracted from published standards. The number to be trained in each specialty will be multiplied by the training costs and the annual attrition factor. The sum of the products so obtained will be the annual training costs.

(2) It will frequently be necessary to estimate the training costs when it has not been determined which military service is to have operations and maintenance responsibility. In such instances costs should be computed for each service, and a composite DCS costs be computed by multiplying the Army's costs by 61 percent, the Navy's cost by 7 percent, and the Air Force's cost by 32 percent. This procedure is illustrated in table 26-5.

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TABLE 26-4. ANNUAL TRAINING COSTS

Service	MOS NEC AFSC	Training Costs	Annual Attrition Rates	Annual Costs
Army (FY 78)	26R	$ 46,160	.174	$ 8,032
	26Y	38,304	.170	6,512
	26Z	48,050	.193	9,274
	32D	37,704	.192	7,239
	32E	49,419	.173	8,549
	32F	46,642	.193	9,002
	32G	25,418	.203	5,160
	32H	19,067	.136	2,593
	34F	55,215	.147	8,117
	34H	55,215	.173	9,552
	34L	24,800	.208	5,158
	36H	30,468	.184	5,606
	52B	16,395	.193	3,164
	52D	21,176	.215	4,553
	71B	18,087	.173	3,129
	76U	14,236	.160	2,278
			Average	$ 6,120
Navy (FY 78)	CE(E6)	$ 18,718	.167	$ 3,126
	DS 1666	32,272	.175	5,648
	ET 1404	21,982	.231	5,078
	ET 1405	21,982	.231	5,078
	ET 1411	22,805	.149	3,398
	ET 1415	22,041	.161	3,549
	ET 1434	29,078	.149	4,333
	ET 1462	29,078	.184	5,350
	RM 2318	15,292	.207	3,165
	RM 2361	27,478	.214	5,880
	IC 4713	7,204	.151	1,088
	EM 5632	15,466	.131	2,026
			Average	$ 3,876

#

TABLE 26-4. ANNUAL TRAINING COSTS (CON.)

Service	MOS NEC AFSC	Training Costs	Annual Attrition Rates	Annual Costs
Air Force (FY 85)	291XX	$ 10,133	.183	$ 1,854
	295XX	4,980	.205	1,021
	304XX	18,750	.191	3,581
	306XX	16,087	.178	2,863
	307XX	15,709	.191	3,000
	361XX	12,741	.198	2,523
	362XX	17,022	.165	2,809
	542XX	9,406	.177	1,665
	645XX	11,291	.186	2,100
			Average	$ 2,380

Sources: Actual FY 1978 training costs for Army and Navy supplied by services. FY 1985 Air Force costs from AFP 173-13, 1 Feb 85. Actual retention rates for all three services are given for 1978.

TABLE 26-5. COMPOSITE TRAINING COSTS
(Communications Terminal)

Organization	Classification	Qty.	Training Costs	Attr. Rates	Annual Costs
Army	26R	2	$46,160	.174	$16,064
	32H	3	19,067	.136	7,779
	52B	1	16,395	.193	3,164
	Total Training Costs - Army (FY 78)				$27,007
Navy	ET1404	1	$21,982	.231	$ 5,078
	ET1411	4	22,805	.149	13,592
	CE(E6)	1	18,718	.167	3,126
	Total Training Costs - Navy (FY 78)				$21,796
Air Force	29530	1	$ 4,980	.205	$ 1,021
	30430	3	18,750	.191	10,744
	30630	2	16,087	.178	5,727
	Total Training Costs - Air Force (FY 85)				$17,492

Composition		Annual Cost		Econ. Escal.[1]	
Army: 61%	x	$27,007	/	.622	$26,486
Navy: 7%	x	$21,796	/	.622	2,453
Air Force: 32%	x	$17,492	/	1.000	5,597
FY 1985 DCS Composite Rate (6 Specialists)					$34,536

[1]Economic escalation factors from table 38-1 are applied to obtain FY 1985 costs.

Source: Costs from table 26-4; DCA, Code 690, Apr 85.

5. Hospitals.

a. General. This element encompasses the medical costs for operation of the military hospitals and Government-paid costs for civilian hospitals associated with care of military personnel and their dependents. Also

included are authorized hospital costs applicable to civilian personnel and their dependents located in overseas areas. Excluded are the operating costs for base dispensaries, and medical and dental clinics included in base operations. (See paragraph 2.)

b. Use of Tables. Annual costs are shown in table 26-6 for the military departments. These factors are to be multiplied by the expected authorized organizational strength.

#

TABLE 26-6. ANNUAL MEDICAL SUPPORT COST

	Cost Per Military Authorization			
Location	Army	Navy	Air Force	DCS Composite
Worldwide	$440	Unknown	$758	$550
CONUS	450			
OCONUS				
Alaska	350			
Hawaii	480			
Korea	440			
Europe	350			
Panama	770			

NOTE: Base Year FY 1985.

Source: "US Army OMA and MPA Cost Factors Handbook," Exhibit III-9, 28 Dec 84; AFR 173-13, figure 7-1, 1 Feb 85; DCA, Code 690.

6. Military PCS Travel.

a. General. The military departments centrally fund and budget for PCS travel requirements; however, this expense is a necessary operating support cost to individual program and project cost estimates. The estimated cost to the military departments has been stated on an annual basis and on an individual-move basis to provide easily calculated estimates of the total PCS travel costs involved in a project. The annual cost is included in the composite standard rates of chapter 23.

b. Use of Table 26-7. In the absence of specific data, the factor "Annual Cost per Personnel Authorization" may be used to estimate the annual recurring costs by multiplying the respective numbers of authorized officers and enlisted men by the factors shown for the service involved. Factors for cost per move may be used when specific data are available for estimating initial costs for a particular budget year; however, for estimates covering the life cycle of a system, the annual cost should be utilized. When the service or grade composition is not known, the DCS composite may be used.

c. Estimating Procedure.

(1) Example 1. Twenty military personnel are required at a communications site at an overseas location. Composition and grades are unknown.

20 X $1,220 = $24,400 annual PCS cost.

(2) Example 2. An Air Force communications unit of 3 officers and 28 airmen is being returned to CONUS from Okinawa. Cost for return PCS travel is desired.

#
3 X $8,345 = $ 25,035
28 X $4,565 = 127,820

TOTAL: $152,855 PCS cost for return trip.

#

TABLE 26-7. PCS TRAVEL

	Army	Navy	Air Force	USMC	DCS Composite
Annual Cost Per Personnel Authorization					
Officer	$2,464	$2,113	$ 2,205	$2,250	$2,350
Enlisted	965	786	1,476	756	1,120
DCS Composite	1,080	1,020	1,520	1,610	1,220
Cost Per Move					
Within CONUS or Overseas Area					
Officer	$4,900		$5,117		$5,000
Enlisted	1,400		2,849		1,900
DCS Composite	1,700		2,990		2,100
CONUS to/from Overseas					
Officer	$8,900		$8,345		$8,700
Enlisted	2,450		4,565		3,200
DCS Composite	3,000		4,790		3,600
Worldwide Average					
Officer			$ 4,597		
Enlisted			2,288		
DCS Composite			2,430		

NOTE: Base Year FY 1985.

Source: NAVCOMPTNOTE 7041, 7 Mar 85; AFR 173-13, tables 3-6 and 3-7, 1 Feb 85; "US Army OMA and MPA Cost Factors Handbook," Exhibit III-13, 28 Dec 84; DCA, Code 690, May 85.

CHAPTER 28. COMMUNICATIONS SERVICES INDUSTRIAL FUND (CSIF) SUBSCRIBER RATES

1. General.

a. Currently, within DoD, an activity may be either funded directly from an appropriation or funded through a revolving fund such as an industrial fund. Where an industrial fund is used, operating costs are paid initially from a segregated fund or corpus which is set up to finance the costs of a cycle of operations that are subsequently reimbursed to the fund by the customers of the activity. The Communications Services Industrial Fund (CSIF) is a DoD revolving fund used to centrally procure communications services from commercial carriers for DoD and for authorized non-DoD departments and agencies. Customers place their orders for service with DECCO. In turn DECCO orders commercial services from commercial companies to satisfy user's requests. The services are provided by commercial companies for the customers. The commercial companies then bill DECCO. DECCO verifies the bills then pays the commercial companies from the corpus of the CSIF. The customers who were provided service are then billed by DECCO. The funds collected from the customers are returned to the CSIF working capital corpus.

b. This chapter covers the standard services and equipment which may be secured through the CSIF. The charges for each service cover the expenses of that service. The rates are designed to assure that the CSIF operates at a "break-even" level. In general, the CSIF rates cover only the "backbone" charges associated with the switches and leased interswitch trunks. The user must separately secure terminal equipment, access lines to the switch, and attachment to the switch. In addition to the rates for the backbone and terminal equipment (listed in this chapter), subscribers must pay for all leased access lines or other private line services (contained in chapters 29 and 30), as well as any other charges which may be unique to their service. Unless noted otherwise, the charges tabled are budgetary cost-to-the-user. Instructions for calculation of cost-to-the-Government are presented at the end of the sections.

c. Planning rates are published each February for the outyears. During # the OSD budget review cycle, changes may be made in either the estimated demand for services or the estimated costs. Revised planning rates reflecting these changes are included in the annual letter.

2. Derivation of Factors. Subscriber rates for CSIF-financed systems were developed by the DCA Communications Services Industrial Fund Division (Code 670). Average charges for termination on the user's site and attachment to the switch were computed based on current FCC approved tariffs. All rates are subject to change.

3. AUTOVON.

a. General. AUTOVON is the common user automatic switched voice network for DoD and authorized non-DoD users. AUTOVON subscribers are responsible for the payment of costs associated with access lines, terminal equipment, and termination charges (paragraph 8 and chapters 29 and 30), and for termination charges as well as a share of the cost of the backbone network of lines and switches (this paragraph). Narrowband secure voice (AUTOSEVOCOM) is obtained by use of appropriate terminal equipment. See Pricing and Availability Information for COMSEC Equipment, KAG-25/TSEC. Three types of service are available: send-and-receive, send-only, and receive-only. The subscriber rates (backbone charges) are not levied against users of receive-only service, but such users must pay for the required termination and terminal equipment and the access lines.

b. Subscriber Rates for AUTOVON Backbone Service. The subscriber rate structure is based upon the type of service provided, preemption capability, and the Maximum Calling Area (MCA). The following MCA's are authorized:

(1) Local MCA. In Europe and the Pacific the local MCA provides access to users attached to the same switch.

(2) Area MCA. Area MCA subscribers in the four major geographical areas (CONUS, Europe, Pacific, and the Caribbean) may communicate with other customers located in the same major geographical area.

(3) Area Plus. The (overseas) Area Plus (CONUS) MCA permits transoceanic communications by providing communications between the overseas MCA and CONUS. It also permits communications between CONUS Air Force subscribers and the Canadian Network (CADIN - Continental Air Defense Integration North).

(4) Global MCA. The Global MCA permits communications between an AUTOVON subscriber and any other AUTOVON subscriber regardless of geographical area.

c. Use of Tables. Table 28-1 provides the cost-to-the-user planning rates for send-and-receive service. When other than Routine service is required, multiply the rates by the appropriate weight shown. For send-only or phone/data service, the rate should be doubled.

d. Example. To compute the cost for AUTOVON service, the termination and access fees must be added to the backbone charges (figure 28-1). As an example, assume a subscriber in CONUS requires service with Immediate precedence to subscribers in the United Kingdom. A 110-mile access line is needed to reach the telephone exchange of the servicing AUTOVON switch.

Item		Monthly Charge
Terminal Equipment and Termination Charge:		
# Termination to a nonsecure location and access to the switch in a remote exchange (table 28-11)		$ 215
Access Line (assume A - B rates):		
Fixed fee	$341.27	
10 miles @ $0.93	x9.30	
Total Cost (chapter 30, table 30-1)		$ 351
Backbone Service (table 28-1):		
Europe + CONUS service with Immediate precedence	$1,055 x3	$3,165
Total Budgetary Cost-to-the-User (per month)		$3,731

e. Cost-to-the-Government. The CSIF charges for the AUTOVON backbone are not included in the calculation of the economic cost-to-the-Government. In the example above, delete the $3,165 for the backbone. The cost-to-the-Government is the termination and access line cost.

4. AUTODIN.

a. General.

(1) AUTODIN subscriber charges are based upon the category and speed of service. AUTODIN services were designed with narrative record service as the primary application. Subsequent modifications have added query/response service for data base transactions and sequential delivery service for applications, such as facsimile, where the order of arrival is important. Reference material for the AUTODIN services are DCAC 310- D70-60, Operating Procedures for Query/Response Service, and DCAC 310-D70-63, Operating Procedures for Sequential Delivery Service. These describe the basic AUTODIN transmission service (secure message switched service at speeds up to 4800 b/s). Many kinds of communications can be obtained through AUTODIN depending upon the terminal equipment. Examples include teletype, facsimile, or computer magnetic tape transfer. The number of approved terminal devices is too large for inclusion here; cf. DCAC 310-D130-3, Approved DCS AUTODIN Terminal (Hardware and Software) Systems.

(2) In addition to the monthly rates for the backbone service, the users must pay the cost of leased access lines (paragraph 7, chapters 29 and 30) and any other charges imposed by the carriers in their area. The charge for termination of the access line at the user's site and the switch is given

in paragraph 9. The terminal equipment itself is additional. Further information on modes of operation, speed of service, terminal equipment, etc., may be obtained from the references cited above.

b. Use of Tables. Table 28-2 presents backbone rates for regular and query/response AUTODIN services. For example, a user wanting low-speed regular AUTODIN service should plan upon a budgetary expense for backbone charges of ($875 x 2 = $1,750) during FY 1986. The computations for AUTODIN service are similar to those required for AUTOVON. See paragraph 3.

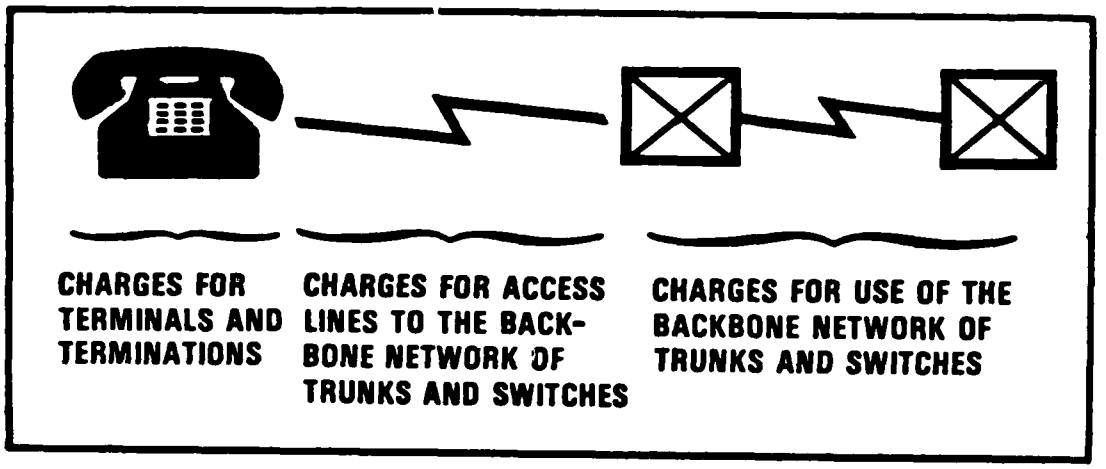

FIGURE 28-1. ILLUSTRATION OF AUTOVON COST ELEMENTS

c. Cost-to-the-Government. Adequate capacity exists within the store-and-forward switches and interswitch trunks to accommodate reasonable increases in demand without additional expenditure for resources. Thus, there is no out-of-pocket cost for added load on the backbone AUTODIN network. Such costs may be incurred for access lines and terminal equipment. In the case of a user leaving a dedicated network and substituting AUTODIN service, there will usually be a savings to the Government as the access lines will be cheaper than the displaced network.

5. ARPANET. The ARPANET is an intercomputer, packet-switched network linking DoD-sponsored research centers and activities in CONUS, Hawaii, Norway, and the United Kingdom. The network can process bulk and interactive data communications. The transit time of a message is normally less than 250 ms. The CSIF fee for the ARPANET is computed on a node (TIP/IMP) basis regardless of the amount of traffic which enters or exits the network through the node. An existing node may be expanded by means of a BBN C/30 IMP or TAC to accommodate additional hosts. CSIF planning rates are shown in table 28-3. The user must pay for access to the node and for the termination charges. Beginning in FY 1987, ARPANET backbone services will be billed based on a cost per month for each occupied IMP host port.

#

TABLE 28-1. AUTOVON CSIF PLANNING RATES

Maximum Calling Area (MCA)	FY 1986 Monthly Rate Per Weighted Unit
Local	
Europe	$ 29
Pacific	307
Area	
CONUS	696
Europe	59
Pacific	613
CADIN (Air Force only)	689
Area Plus	
CONUS and Europe	1,097
CONUS and Pacific	1,497
CONUS and Caribbean	916
Global	2,118

Preemption Capability	No. of Weighted Units
Flash	4
Immediate	3
Priority	2
Routine	1

NOTE: For Phone/Data and PBX (Send Only) Service, double the charge shown.

Source: "Communications Services Industrial Fund (CSIF) Planning Rates," 25 Feb 85, DCA, Code 670.

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TABLE 28-2. AUTODIN CSIF PLANNING RATES

FY 1986 Monthly Rates

Speed of Service	Regular Service: No. of Weighted Units	Regular Service: Rate Per Access Line[1]	Query/Response[2]: Area	Query/Response[2]: Area Plus	Query/Response[2]: Worldwide
High Speed			$3,500	$5,000	$6,500
4.8 kb/s	12	$10,500			
2.4	8	7,000			
Medium Speed			1,800	2,700	3,600
1.2	6	5,250			
0.6	4	3,500			
Low Speed			900	1,200	1,500
0.3 or less	2	1,750			

[1]Charge per Weighted Unit is $875.
[2]Charges include access to one terminal or host. Add $100 for each additional terminal/host accessed.

Source: "Communications Services Industrial Fund (CSIF) Planning Rates," 25 Feb 85; DCA, Code 670.

6. Defense Data Network (DDN). CSIF charges for the DDN are currently set at flat monthly rates for all DoD activities, based on their projected usage. For non-DoD activities, the rates are based on cost per month for each occupied IMP host port. Generally, the non-DoD users represent those activities which have been transferred from ARPANET into the MILNET. Also included are all WWMCCS Intercomputer Network (WIN) customer activities. Separate WIN backbone rates have been discontinued as of FY 1985.

TABLE 28-3. DDN and ARPANET CSIF PLANNING RATES

	FY 1986 Monthly Rates
DDN	Flat rate for each DoD activity
ARPANET	$11,500 per node + 10% for each additional collocated IMP or TAC

Source: "Communications Services Industrial Fund (CSIF) Planning Rates," 25 Feb 85; DCA, Code 670.

7. Multiplexed and Bulk Systems.

a. General. DCA operates several multiplex and bulk encrypted circuit systems to reduce the total cost of communications. The costs of the multiplexers and trunks are shared by the users. A DECCO management fee of 1 percent must be added to the stated rates. The decision as to the type and location of multiplex services is determined by an economic analysis. The guidelines for analysis and funding of multiplex systems are found in DCAC 310-70-59, DCA Management of DoD Multiplex Systems. The economic analysis examines whether a multiplex system should be installed in a particular area. A different economic analysis would be required to determine whether it would be cost effective to activate another circuit over an existing route. As in all systems operated by the CSIF, the user must fund any access lines needed to reach the multiplex network.

b. Transoceanic Service. Table 28-4 lists the routes and rates for transoceanic channel packing and voice frequency carrier telegraph (VFCT) service. Nonstandard expenses, such as connection to a circuit not compatible with the DCS multiplex or special routing expenses, will be charged to the user. Costs of a circuit to other areas will be prorated among all users of the circuit until a standard rate can be established for the circuit.

c. CONUS Voice Frequency Carrier Telegraph (VFCT). Table 28-5 lists the current location of VFCT nodes and the per mile charge.

TABLE 28-4. TRANSOCEANIC MULTIPLEX SERVICE CSIF PLANNING RATES

			FY 1986 Monthly Rates	
			75 b/s	2,400 b/s
CONUS	-	Europe	$ 550	$8,280
	-	Puerto Rico	335	N/A
	-	Bermuda	420	N/A
	-	Canal Zone	680	N/A
	-	Japan	N/A	9,650
East Coast	-	Hawaii	420	N/A
	-	Guam	7,750	N/A
	-	Australia	1,350	N/A
West Coast	-	Hawaii	470	2,410
	-	Guam	830	N/A
	-	Japan	390	N/A
	-	Australia	1,490	N/A
Hawaii	-	Guam	360	4,660
	-	Philippines	435	5,670
	-	Japan	550	10,110
	-	Australia	930	N/A
Guam	-	Philippines	445	8,070
	-	Japan	710	9,120
	-	Australia	1,290	N/A
Philippines	-	Japan	1,865	15,930
	-	Australia	N/A	N/A

NOTE: 1200 b/s service is available at 50% of the 2400 b/s rate. Speeds less than 1200 b/s can be obtained as multiples of the 75 b/s rate.

Source: "Communications Services Industrial Fund (CSIF) Planning Rates," 25 Feb 85; DCA, Code 670.

TABLE 28-5. CONUS VFCT LINKS

End Points		Airline Miles
Andrews AFB, MD	Ft. Detrick, MD	46
	Ft. Meade, MD	18
	Ft. Ritchie, MD	65
	Kelly, TX	1,389
	McClellan, CA	2,376
	Norfolk, VA	145
	Patrick, FL	761
	Pentagon, VA	10
	Stockton, CA	2,377
	W. Sweetgrass, MT	1,860
Boca Chica, FL	Homestead, FL	105
Cape Canaveral, FL	Vandenberg, CA	2,376
Ft. Detrick, MD	Ft. Leavenworth, KS	933
	Ft. Meade, MD	45
	Ft. Ritchie, MD	22
	McClellan, CA	2,342
	Norfolk, VA	188
	Patrick, FL	789
	Pentagon, VA	41
	Stockton, CA	2,343
Ft. Leavenworth, KS	Ft. Ritchie, MD	927
	Kelly, TX	705
	McClellan, CA	1,423
	Point Reyes, CA	1,500
	Offutt, NE	145
Ft. Ritchie, MD	Carlisle Barracks, PA	38
	McClellan, CA	2,334
	Pentagon, VA	62
	Stockton, CA	2,335
	Ft. Meade, MD	60
	Arlington, VA	62
Norfolk, VA	Boca Chica, FL	912
	Cutter, ME	716
	Pentagon, VA	148

TABLE 28-5. CONUS VFCT LINKS (CON.)

End Points		Airline Miles
San Diego, CA	Long Beach, CA	96
	Stockton, CA	435
Whidbey Island, WA	Stockton, CA	723

NOTE: FY 1986 CSIF monthly planning rate is $0.157 per airline mile. Services above 75 b/s will be charged as multiples of that rate.

Source: "Communications Services Industrial Fund (CSIF) Planning Rates," 25 Feb 85; DCA, Code 670.

TABLE 28-6. CONUS CHANNEL PACKING LINKS

End Points		Airline Miles
Alexandria, VA	Los Angeles, CA	2,292
	San Diego, CA	2,255
Cameron Station, VA	Kirtland, NM	1,643
	Wright-Patterson, OH	381
Ft. Ritchie, MD	Offutt, NE	1,311

NOTE: FY 1986 CSIF monthly planning rate for 2.4 kb/s service is $0.52 per airline mile. Speeds over 2.4 kb/s are charged as multiples of that rate.

Source: DECCO Code D650, 5 Jul 79; "Communications Services Industrial Fund (CSIF) Planning Rates," 25 Feb 85; DCA, Code 670.

TABLE 28-7. EUROPEAN CHANNEL PACKING SERVICE CSIF PLANNING RATES

Intra-Europe Links

Croughton, UK	Coltano, IT	Pirmasens, FRG	Coltano, IT
	London, UK		Vaihingen, FRG
	Pirmasens, FRG		London, UK
	Rota, SP		
	Vaihingen, FRG	San Vito, IT	Hellenikon, GR
			Iraklion, GR
Boerfink, FRG	Gablingen, FRG		

NOTES: FY 1985 CSIF planning rate for 1.2 kb/s service is $1,310 per month. Services above 1.2 kb/s will be charged as multiples of that rate. Ft. Meade, MD, to Chicksands, UK, service at 1.2 kb/s is available at $5,700 per month.

Source: "Communications Services Industrial Fund (CSIF) Planning Rates," 25 Feb 85; DCA, Code 670.

d. CONUS Channel Packing. CONUS channel packing provides for service at 1.2 kb/s, 2.4 kb/s, and higher speeds. Table 28-6 lists the current locations of and per-mile charges for CONUS channel packing nodes.

e. European Channel Packing. European channel packing provides for service at 1.2 kb/s, 2.4 kb/s, 4.8 kb/s, and 7.2 kb/s. Table 28-7 lists the current locations of and per-mile charges for European channel packing.

f. Bulk Encrypted Circuits. 1.544 Mb/s systems are charged at the rates contained in table 28-8.

g. Washington Area Wideband Service (WAWS). The Washington Area Wideband Service (WAWS) is an all-digital, bulk-encrypted service which can go up to 90 mb/s. In addition to the security offered by bulk encryption, the WAWS hardware provides for high reliability and low bit error rate. Table 28-9 lists the WAWS service points and rates.

h. Overhead Rates. The DECCO overhead charges of one percent for DoD and 1.25 percent for non-DoD users must be added to the WAWS rates.

TABLE 28-8. 1.544 MB/S CSIF PLANNING RATES

System	FY 1986 Monthly Per Channel Charge
CONUS - Puerto Rico	$1,360
West Coast - Hawaii	2,410
McClellan AFB, CA - Neklason Lake, AK	1,310

Source: "Communications Services Industrial Fund (CSIF) Planning Rates," 25 Feb 85, DCA, Code 670

8. Defense Commercial Telecommunications Network (DCTN). Table 28-10 provides CSIF planning rates for FY 1986 non-switched data and voice, and video service. For voice and data service the rate is computed on a cost per circuit end. For example, 9.6 Kbps service between Edwards AFB and Langley AFB would cost $1,242 ($657 for Edwards plus $584 for Langley). The rates for video service represent full-time service per end location. Rates for time sharing are under development and will be provided later.

9. Terminal Equipment. The complete list of terminal equipment which may be attached to AUTOVON, AUTODIN, or dedicated circuits is too large for presentation here. Table 28-12 gives average prices for attachment to the access line and attachment of the access line to the switch. The cost of the terminal equipment is additional. Much of the equipment located in CONUS is leased from the carriers under tariff. Overseas the equipment is usually Government owned. Lease charges for specific locations can be obtained from the servicing telephone and telegraph companies. For equipment which is to be purchased or leased from noncarriers, users are directed to GSA schedules, vendor price lists, or other chapters of this manual; e.g., chapter 11, Multiplex Equipment. For leased equipment the cost-to-the-Government is the fee stated in the tariff. The cost-to-the-user is the fee plus the DECCO overhead charge. For Government-owned equipment, such as COMSEC, the cost-to-the-Government is either zero for equipment which would otherwise go unused, or it is the procurement cost of the additional equipment.

TABLE 28-9. WAWS CSIF PLANNING RATES

Point-to-Point	FY 1986 Monthly Rates 1.544 mb/s	40.8-64.0 kb/s	9.7-40.0 kb/s	.150-9.6 kb/s and Voice
Andrews - Site R	$10,595	$1,990	$535	$175
Andrews - Ft. Detrick	1,825	1,780	430	150
Andrews - Ft. Meade	996	890	220	80
Andrews - Naval Security Sta.	875	700	445	32
Andrews - Pentagon	4,045	780	140	25
Site R - Ft. Belvoir	12,405	2,010	560	170
Site R - Ft. Detrick	11,225	1,790	325	160
Site R - Ft. Meade	9,185	1,100	315	90
Site R - Naval Security Sta.	8,325	1,040	200	95
Site R - Pentagon	7,545	795	170	80
Friendship Annex - Ft. Meade	1,755	-	-	-
Ft. Belvoir - Ft. Detrick	5,260	1,800	450	150
Ft. Belvoir - Ft. Meade	3,000	910	240	80
Ft. Belvoir - Naval Sec. Sta.	874	800	300	155
Ft. Belvoir - Pentagon	4,375	955	300	160
Ft. Detrick - Ft. Meade	2,040	890	210	70
Ft. Detrick - Naval Sec. Sta.	2,175	1,230	290	95
Ft. Detrick - Pentagon	3,755	1,075	240	80
Ft. Meade - Naval Sec. Sta.	987	700	225	75
Ft. Meade - Pentagon	874	835	240	80
Naval Sec. Sta. - Pentagon	785	245	50	15
Paris - Pentagon	3,700	308	195	140
Pentagon - State	3,713	309	200	150

NOTE: Color TV is offered at $102,000 per month which includes associated A/D converters necessary for interfacing the video with the WAWS Transmission Media. Service at speeds above 1.544 mb/s is priced as multiples of the 1.544 mb/s rate.

Source: "FY 1986 Communications Services Industrial Fund (CSIF) Planning Rates," 25 Feb 85, DCA, Code 670.

TABLE 28-10. DCTN CSIF PLANNING RATES

Location	FY 1986 Monthly Rates Kbps 4.8	Kbps 9.6	Kbps 50	Kbps 56
Aberdeen Proving Grounds	$ 457	$ -	$1,049	$ 941
Alexandria Army Materiel Cmd.	644	-	1,072	965
Andrews AFB	317	544	-	719
Arlington Crystal Mall	-	587	-	-
Arlington Navy Annex	-	587	-	-
Arnold Air Force Station	970	-	-	-
Advanced Research Projects Agency	-	-	1,339	-
Atlanta - GSA	364	-	-	-
Brooklyn Air Force Recruiting Office	-	724	-	-
Brooks AFB	302	-	-	-
Cameron Station	364	-	-	-
Camp Pendleton	345	-	-	-
Dayton Centrex-258	318	-	-	-
Detroit Arsenal	730	952	-	2,471
Detroit - GSA	654	-	-	-
Dobbins AFB	-	674	-	-
Dover AFB	601	824	-	-
Edgewood	424	833	-	-
Edwards AFB	433	657	1,056	949
Ft. Bragg	692	-	1,576	1,469
Ft. Campbell	530	-	-	-
Ft. Detrick	396	-	-	717
Ft. Dix	-	-	-	878
Ft. Huachuca	778	-	-	-
Ft. Knox	-	-	-	1,099
Ft. Leonard Wood	997	-	-	-
Ft. Meade	-	619	1,041	-
Ft. McPherson	297	-	-	-
Ft. Monmouth	300	-	729	622
Ft. Sam Houston	300	-	-	-
George AFB	533	-	-	-

TABLE 28-10. DCTN CSIF PLANNING RATES (CON.)

Location	FY 1986 Monthly Rates Kbps 4.8	Kbps 9.6	Kbps 50	Kbps 56
Harrisburg - GSA	$478	$ -	$ -	$ -
Hill AFB	301	529	-	-
Huntsville - GSA	303	-	-	-
Kelly AFB	297	522	-	-
Langley AFB	299	584	-	-
Letterkenney Army Depot	302	-	-	-
Los Angeles AFB	364	-	-	-
Los Angeles Air Force Recruiting Office	436	658	-	-
Los Angeles - GSA	330	-	-	-
McClellan AFB	296	548	-	678
McGuire AFB	406	-	-	-
Mechanicsburg Ships Parts Control Center	616	839	-	-
NBS	-	-	1,750	-
Newark NJ - GSA	451	-	-	-
New Cumberland Army Depot	-	603	-	789
Norfolk Naval Base	483	706	-	-
North Island	304	-	-	-
Norton AFB	377	-	-	-
National Library of Science	-	-	-	1,532
New York University	-	-	1,673	1,566
Oklahoma City AFB	322	-	-	-
Pentagon	308	602	808	-
Picatinny Arsenal	367	720	-	818
Presidio of San Francisco	304	-	-	-
Randolph AFB	321	623	-	727
Redstone Arsenal	299	584	-	683
Robins AFB	405	692	1,003	896
Rock Island Arsenal	485	-	-	1,054

TABLE 28-10. DCTN CSIF PLANNING RATES (CON.)

Location	FY 1986 Monthly Rates Kbps 4.8	Kbps 9.6	Kbps 50	Kbps 56
Salt Lake - GSA	$ 343	$ -	$ -	$ -
San Diego Naval Oceanographic System Command - Rosecranz	-	-	1,339	-
San Diego Naval Oceanographic System Command - Catalina	364	-	-	-
San Diego - GSA	304	-	-	-
San Francisco - GSA	295	-	-	-
Scott AFB	296	548	784	677
St. Louis - Goodfellow	570	-	999	892
St. Louis - GSA	424	-	-	-
Sunnyvale AFB	459	-	-	1,596
Tinker AFB	313	538	-	711
Travis AFB	345	596	-	-
Washington 1 - GSA	316	-	-	-
Washington 3 - GSA	311	-	-	-
Washington 554	405	-	-	-
Wash Navy Yard B194	-	628	-	-
Wright-Patterson AFB	294	575	-	674

Near-Full-Motion Video
FY 1986 Rates

NOTE: $16,000.00 transmit and receive per circuit end.

TABLE 28-11. COST FOR TERMINAL EQUIPMENT AND TERMINATION

AUTOVON		
Termination and First Terminal	Monthly	Installation
Switch in Local Exchange	$190	$ 375
Switch in Remote Exchange	300	500
Surcharge for Secure Termination		
Switch in Local Exchange	5	
Switch in Remote Exchange	42	
Extensions	8	77

AUTODIN		
Termination Charges	Monthly	Installation
Speed (b/s)		
75-1200	$ 600	$2,500
2400-9600	1,200	4,000

Source: DCA, Code 690, Apr 85.

CHAPTER 35. INTERNATIONAL MONETARY RATES OF EXCHANGE

1. General. This chapter contains monetary exchange rates for budgetary and planning purposes. Actual rates are subject to day-to-day fluctuations; however, OSD(C) has directed that rates contained herein be used for the purposes stated. Paying offices will record variations from the designated rates by entering the value of the variations in special accounts established for this purpose.

2. Use of Table. Table 35-1 lists the exchange factors by budget year. To determine the (United States) cost of a contract or lease, first obtain the price in the foreign currency and then convert to U.S. dollars.

a. Example 1. The FY 1985 cost of contract is 2,744,100 yen (Japan). The rate of exchange for Japan is 278.46 yen to the U.S. dollar.

2,744,100 yen/278.46 = $9,855

b. Example 2. The FY 1985 cost of a lease is 3,831 British pounds sterling (United Kingdom). The rate of exchange for the United Kingdom is 0.81 pounds to the dollar.

3,831 pounds/0.81 = $4,730

c. Example 3. These factors can also be used to convert from dollars to local currency. If the amount to be received is $1,000 FY 1983 dollars with payment to be made in Deutsch marks, the calculation is:

$1,000 x 3.22 = 3,220 DM

TABLE 35-1. FOREIGN CURRENCY EXCHANGE RATES

Country	Monetary Unit	Foreign Currency Per U.S. Dollar FY 1986 Budget and FY 1987-91 Formulation Rates
Belgium	Franc	65.55
Canada	Dollar	1.47
Denmark	Krone	11.67
Fed Rep of Germany	Mark	3.22
France	Franc	9.80
Greece	Drachma	115.20
Italy	Lira	1,954.65
Japan	Yen	278.46
Netherlands	Guilder	3.61
Norway	Krone	8.94
Portugal	Escudo	154.09
Spain	Peseta	185.39
Turkey	Lira	302.68
United Kingdom	Pound	0.81

Source: "FY 1986 Revised and FY 1987 Budget Estimates Guidance," OSD(C) Memorandum, 17 Jul 85.

CHAPTER 36. CONSTRUCTION PRICE INDEXES

1. General. The cost indexes given in tables 36-1 through 36-3 represent approximate geographical adjustment factors for construction of repetitive type (not unique or unusual with regard to design or construction techniques used) facilities. For construction of more complex facilities or under extremely abnormal conditions, the indexes should be increased appropriately. The indexes are given for use in review or for broad preliminary planning. They are not intended to be a substitute for local surveys or specific experience.

2. Derivation of Factors. The construction price factors were derived from military department guidance documents as annotated in the sources. For example, actual costs from a survey of 144 cities were used to compute a base index of 1.00 for table 36-1.

3. Use of Tables. Multiply the complete site construction costs, as estimated from chapter 21, paragraph 3, by the composite index factor from the applicable table. For example, if the construction costs from chapter 21, paragraph 3, are $300,000 and the location is Point Barrow, Alaska, a factor of 3.45 will be applied. If the location is Mountain Home, AFB, Idaho, a factor of 1.15 will be applied.

Point Barrow $300,000 X 3.5 = $1,050,000
Mountain Home $300,000 X 1.15 = $345,000

TABLE 36-1. CONSTRUCTION PRICE INDEXES[1]

STATES (FOLLOWED BY EXCEPTIONS[2])	LABOR INDEX	MATERIAL INDEX	COMPOSITE INDEX
ALABAMA	0.90	0.97	0.94
FT. RUCKER	0.52	0.96	0.76
ALASKA (ALEUTIAN IS.)	3.63	2.84	3.19
CLEAR AFB	3.34	1.81	2.49
EIELSON AFB	2.52	1.65	2.03
ELMENDORF AFB	2.52	1.44	1.92
POINT BARROW	3.81	3.16	3.45
ARIZONA	1.16	1.00	1.07
YUMA AND DAVIS-MONTHAN	1.18	1.32	1.25
FORT HUACHUCA	1.18	1.19	1.18
PHOENIX	1.15	0.95	1.04
TUCSON	1.14	1.05	1.08
ARKANSAS	0.93	0.88	0.90

#

TABLE 36-1. CONSTRUCTION PRICE INDEXES (CON.)

STATES (FOLLOWED BY EXCEPTIONS[2])	LABOR INDEX	MATERIAL INDEX	COMPOSITE INDEX
CALIFORNIA	1.53	1.15	1.32
LOS ANGELES	1.49	1.18	1.15
SAN FRANCISCO BAY AREA	1.65	1.11	1.35
COLORADO	1.05	0.95	0.99
DENVER	1.12	1.00	1.05
CONNECTICUT	1.11	1.13	1.12
NEW LONDON	1.11	1.14	1.13
DELAWARE	1.17	0.95	1.05
DISTRICT OF COLUMBIA AREA	1.05	1.12	1.08
FLORIDA	0.84	0.94	0.90
KEY WEST	1.14	1.01	1.07
GULF COAST	0.75	0.94	0.85
MIAMI AND ATLANTIC COAST	1.05	0.98	1.01
GEORGIA	0.69	0.93	0.82
ATLANTA	1.01	0.89	0.94
HAWAII (OAHU)	1.30	1.36	1.34
IDAHO	1.23	0.98	1.09
MOUNTAIN HOME AFB	1.29	1.03	1.15
ILLINOIS	1.13	0.97	1.10
FT. SHERIDAN	1.25	0.98	1.20
INDIANA	1.09	0.97	1.02
IOWA	1.00	0.97	0.98
KANSAS	0.98	0.97	0.97
KENTUCKY	1.00	1.02	1.01
LOUISIANA	1.00	1.00	1.00
MAINE	0.50	1.05	0.81
MARYLAND	0.84	1.02	0.94
PATUXENT RIVER	1.01	1.10	1.05
MASSACHUSETTS	1.16	0.99	1.06
MICHIGAN	1.13	0.99	1.05
DETROIT	1.28	1.02	1.14
MINNESOTA	1.11	1.00	1.02
MISSISSIPPI	0.80	0.97	0.89
MISSOURI	1.02	0.93	0.97
FORT LEONARD WOOD	0.84	0.95	0.90
MONTANA	1.02	1.01	1.01
NEBRASKA	1.03	1.03	1.03
NEVADA	1.37	0.99	1.16
FALLON NAVAL AIR STATION	1.36	1.10	1.21

TABLE 36-1. CONSTRUCTION PRICE INDEXES (CON.)

STATES (FOLLOWED BY EXCEPTIONS[2])	LABOR INDEX	MATERIAL INDEX	COMPOSITE INDEX
NEW HAMPSHIRE	1.03	1.07	1.05
NEW JERSEY	1.20	1.06	1.12
NEW MEXICO	1.10	1.01	1.05
NEW YORK	1.09	1.12	1.10
BROOKLYN	1.25	1.25	1.25
WATERVLIET ARSENAL	0.96	1.04	1.00
NORTH CAROLINA	0.45	0.96	0.73
NORTH DAKOTA	0.88	1.02	0.96
OHIO	1.18	0.93	1.04
CLEVELAND	1.35	1.00	1.16
OKLAHOMA	0.97	0.93	0.95
OREGON	1.18	0.96	1.06
PENNSYLVANIA	1.10	0.99	1.04
NEW CUMBERLAND ARMY DEPOT	0.99	0.91	0.95
RHODE ISLAND	1.13	1.10	1.11
SOUTH CAROLINA	0.46	0.91	0.71
SOUTH DAKOTA	0.85	0.99	0.92
TENNESSEE	0.79	0.93	0.87
NAS MEMPHIS	1.03	0.98	1.00
TEXAS	0.90	0.97	0.94
DALLAS AND CARSWELL	1.05	1.01	1.02
UTAH	1.04	0.95	0.99
VERMONT	0.71	1.07	0.90
VIRGINIA	0.93	1.01	0.97
NORTHERN VIRGINIA	1.05	1.12	1.08
WASHINGTON (STATE)	1.29	0.97	1.11
PUGET SOUND AREA	1.38	1.23	1.30
WEST VIRGINIA	1.05	0.98	1.01
WISCONSIN	1.09	1.01	1.04
WYOMING	1.02	1.07	1.05

[1]Indexes effective date Sep 83.
[2]For more detailed information, see source below.

Source: OASD(MIL), DoD Construction Material and Labor Indices, 1 Mar 84.

TABLE 36-2. CONSTRUCTION PRICE INDEXES

TERRITORIES AND POSSESSIONS OF THE UNITED STATES	INDEX
CANAL ZONE	1.5
CAROLINA ISLANDS (TRUK)	2.0
JOHNSTON ISLANDS	2.4
LINE ISLANDS (PALMYRA)	2.0
MARIANA ISLANDS (GUAM)	1.5
MARSHALL ISLANDS	2.4
MIDWAY ISLAND	2.4
PUERTO RICO (SAN JUAN)	1.4
ROOSEVELT ROADS	1.5
SAMOA	2.4
VIRGIN ISLANDS	1.3
WAKE ISLAND	2.2

Source: "HQ USAF Annual Construction Pricing Guide for FY 85 thru 89 Programs," Jun 82.

CHAPTER 42. REPORT COSTING AND FREEDOM OF INFORMATION REQUESTS

1. General. This chapter discusses procedures and rates for use in estimating the cost of reports submitted in accordance with DCAI 630-225-2, Management and Control of Information Requirements, and fees to be charged for Freedom of Information Act (FOIA) requests made in accordance with DCAI 210-225-1, DCA Freedom of Information Act Program. The term "report" refers to data, information, or reports which are used for specified and authorized Government functions. A report, then, is used primarily by the Federal Government. FOIA requests, on the other hand, always involve a requestor outside the Government who is the primary user. Procedures used to calculate labor costs for reports are different from the ones for FOIA requests. Reports are covered in paragraphs 2 through 4 of this chapter and FOIA requests are covered in paragraphs 5 and 6.

a. The cost of a reporting requirement is the total of nonrecurring and recurring expenses incurred by the Government throughout the life cycle of the report. The cost rates contained in this chapter and in chapters 23 and 24 are used in cost estimation and in the accumulation of actual cost data. Estimated costs are refined or replaced by actual cost data when the reporting requirement is implemented.

b. The factors outlined in this chapter provide a basis for costing either a manual or an automated individual report or reporting system. All of the factors may not apply to a particular report, and there may be additional factors which apply to a specific costing situation.

c. There are three separate stages or times when report costing is required:

(1) Submitted with the request for the institution of a report (estimated cost).

(2) Following the first reporting cycle (week, month, quarter, etc.) during which the reporting requirement was implemented (actual cost).

(3) Annually, at the time all reporting requirements are reviewed for essentiality and continued effective benefits (actual cost versus value).

d. In transactions with non-Government activities when full reimbursement is appropriate, the standard rates must be increased in order to cover additional appropriate costs. These rates are identified as "Non-Government."

2. Derivation of Factors for Tables 42-1 and 42-2.

a. Personnel Costs.

(1) Hourly personnel rates were developed as described in chapters 23 and 24.

(2) Average grades for professional, administrative, and clerical personnel were determined by examining the authorized manning tables.

(3) Average grades for ADP personnel were based on actual personnel assigned.

b. ADP Costs. ADP costs, as stated in terms of the hourly rate, consist of the costs of operating the ADP facility. These costs were determined by adding the costs of computer lease and maintenance, supplies, operations, personnel, and overhead, and dividing the sum by the average annual use of computer resources, such as core storage, processor time, and input-output time.

c. Associated Costs.

(1) General Services Administration (GSA) schedules, National Archives Records Service (NARS) and OMB documents, and DoD directives were sources of information in compiling rates.

(2) Dry reproduction and paper costs were determined from a review of current billings and of charges given in Change 3 to DoD Directive 5400.7. Cost per page excludes clerical time required for personnel to operate the machine.

(3) Mailing costs include U.S. Postage Service charges and pouch handling and personnel costs other than those incurred in the office preparing or receiving the report; mailing costs are found in GSA studies and current FY pay tables.

(4) DoD CONUS AUTODIN cost per message was developed from current reported message volume, related AUTODIN backbone costs, salaries of personnel performing the message-handling service, headquarters supervision costs, and estimated terminal operation and maintenance costs incurred by the military departments.

(a) The per-message rate was determined from outgoing message traffic; therefore, reports forwarded by two separate locations should be costed as two messages, and one outgoing report to two or more receiving locations is costed as one message.

(b) Generally, a single AUTODIN message is equivalent to approximately 21 typed lines of report data or, when punch card input of 80 characters or less is used, 67 lines of punch card data.

(5) Manual file storage costs were developed from GSA factors. Fifteen percent of the total dollar cost is filing equipment cost amortization, and 85 percent of the total is space and maintenance cost.

(6) Specific contract prices and GSA schedules may be used to obtain fixed costs, such as contract printing, equipment purchases, tape, cards, and other supplies.

3. Use of Tables 42-1 and 42-2. In costing reports, use tables available in chapters 23 and 24 to assist in determining both military and civilian hourly costs. In addition, table 42-1 reflects other factors and rates to be used in costing other aspects of reporting. The following explains, in general terms, how the various tables can be used.

a. Table 23-2. When military grade is known, use the appropriate hourly rate for report costs in table 23-2. When grade is unknown, see table 42-2 or use O-3 for officers and E-5 for enlisted personnel.

b. Table 24-1. Use table 24-1 for Government reports when the civilian grade is known. When grade is unknown but occupational series is known, use table 24-3 to determine grade. Alternatively, see table 42-2 for average grade levels.

c. Table 42-1. The list of cost factors in this table is not all-inclusive, but represents items for consideration in costing of reports. The use of these factors is self-explanatory.

4. Estimating Procedure.

a. An estimate of the annual cost is prepared when an office is requesting approval of a new or revised report. Generally, the annual cost can be obtained by determining the cost of one full reporting cycle (day, month, quarter) and projecting this figure to obtain the annual cost. Figure 42-1, Summary Worksheet for Estimating Reporting Costs, is followed by an example which demonstrates how report costs are compiled.

b. Feeder report costs incurred by responding organizations solely for submitting data for a single report must be included in the estimated and actual report costs. If feeder reports already exist or will have multiple uses, only that portion of the costs required to collect and modify or manipulate the data exclusively for the new report need be included.

c. ADP personnel and equipment costs are normally provided by the ADP facility to the Office of Primary Responsibility (OPR) for each report, using DCA Form 319: Request for ADP Services. Table 42-1 indicates the approximate cost per hour for use where an accurate cost from the processing organization is not available.

d. To facilitate the gathering and evaluation of data, cost elements have been separated into three functions: developmental costs, operational costs, and user costs. All of these functions and their related subelements must be included in the cost estimate and the reporting of actual costs.

(1) Developmental Costs. Developmental costs result from those activities necessary for establishing a new requirement or modifying an existing reporting requirement. Developmental costs may include:

(a) Specification of Reporting Requirement. Preliminary activities, including:

1. Determining the specific reporting need.

2. Identifying the scope and objectives of the reporting system.

3. Appraising the interface and impact on other planned and existing reporting systems.

4. Determining benefits to be derived from the proposed reporting requirement.

5. Developing a working agreement among organizational components involved with designing the reporting system.

(b) Analyis of Reporting Requirement. The determination of the information to be provided by the reporting system, including:

1. Certifying the need.

2. Discussing and determining the needed information.

3. Selecting available or appropriate data sources, media, and processing requirements.

4. Developing reporting system output requirements and specifications.

(c) Design of Reporting System. The preparation of the written description of the proposed system, including:

1. Determining needed processing of input documents.

2. Developing input and output documents, to include standard data elements as applicable.

3. Establishing data files and other related documentation.

(d) Installation of Reporting System. The conversion of the written instruction, or plan, to an operable ongoing reporting system, including:

1. Programing and debugging a computer-oriented reporting system.

2. Acquiring and installing new equipment or modifying existing equipment.

3. Developing, writing, and issuing implementing directives and other instructions.

4. Scheduling and performing tests of the reporting system during installation.

5. Scheduling and conducting training and orientation.

6. Preparing the ADPE site.

(2) Operational Costs. Operational costs result from those continuing activities necessary to prepare and transmit a report. Operational costs include:

(a) Data Collection. The activity necessary to acquire, record, and make available data at some other location or time, including:

1. Assembling and recording source data by the various preparing units.

2. Controlling the accuracy of source data.

3. Forwarding source data to a processing unit.

4. Storing source data for future reference.

(b) Data Processing. The manipulation of data into the desired structure or format for evaluation and analysis, including:

1. Receiving, controlling, and editing source documents at the processing unit.

2. Summarizing source data and converting it to machine-readable data.

3. Updating the data base file.

4. Extracting and compiling data in the desired report media and format.

5. Posting data on worksheets and developing narrative, statistical, or graphic displays.

(c) Data Transmission. This includes reproduction and distribution of completed reports from processing units.

(3) User Costs. User costs result from those normal operations performed on the transmitted information by the requiring office. User costs include:

(a) Refining, interpreting, and analyzing the information received.

(b) Reading, reviewing, discussing, and documenting information presented; e.g., hard copy report, briefing sessions, remote terminal response.

(c) Local filing and remote storage in records respository for future reference.

(d) Destruction of records.

TABLE 42-1. REPORT COST FACTORS[1]

Cost Factor	Government	Non-Government
ADP (approximate hourly rate)	$171.00	
Mailing (per report) (includes U.S. Postal Service charges)	2.75	$3.30
DoD CONUS AUTODIN (per message)	1.41	1.41
File Storage Costs - Manual		
Secure (per classified document)	8.75	8.95
Nonsecure (per cubic foot)	5.10	5.20
Dry Reproduction (per page) (includes paper)	.05	.05
Existing Publications (per printed page)	.01	.01
Microfiche, per fiche in stock	.06	.06
Microfiche, Reproduction, first fiche	N/A	5.00
Microfiche, Reproduction, additional fiche	N/A	.10
Printing Reports (per page)	.05	.05
Reading Cost at Professional Level/Professional Search/Computer Programer	GS-11 Rate	GS-11 Rate

[1]Cost based on FY 1985 salaries unless otherwise dictated by OSD.

TABLE 42-2. AVERAGE PERSONNEL GRADE LEVELS

	Overhead		Automatic Data Processing			
	Professional	Admin/ Clerical	Analyst	Programer	Specialist	Computer Operator
DCA HQ						
Officer	(05+04)/2	-	-	0-4	-	-
Enlisted	E-7	E-4	-	-	-	-
Civilian	GS-13	GS-6	GS-13	-	GS-13	-
DCA Field Wash, D.C. Area						
Officer	0-4	0-2	0-3	0-4	-	0-2
Enlisted	E-7	E-4	E-7	E-6	E-8	E-6
Civilian	GS-13	GS-6	GS-13	GS-12	GS-9	GS-9
DCA Field Outside Va, Md, D.C.						
Officer	0-4	0-2	-	-	-	-
Enlisted	E-7	E-3	E-6	E-6	-	E-5
Civilian	GS-13	GS-5	GS-13	GS-13	GS-12	GS-5

Source: DCA, Code 690, based on 9 Dec 77 PERMIS report data.

SUMMARY WORKSHEET FOR ESTIMATING REPORTING COSTS

REPORT SYMBOL	REPORT TITLE	ESTIMATE PREPARED BY	DATE
DCA(SA) 630-02	Estimating Reporting Costs	A.T. BENTON	1 September 1977

FACTORS		COSTS ($)					
REPORTING CATEGORIES	REPORTING ACTIVITIES	DIRECT PERSONNEL (a)	OVERHEAD (___% of column (a)) (b)	DIRECT EQUIPMENT (c)	DIRECT MATERIAL (d)	OTHER DIRECT COSTS (e)	TOTAL (a+b+c+d+e) (f)
DEVELOPMENTAL COSTS	1. Specification of Reporting Requirement	$ 607	INCLUDED IN COLUMN (A) COSTS				$ 607
	2. Analysis of Reporting Requirement	180					180
	3. Design of Reporting System	477				110,066	$110,543
	4. Installation of Reporting System	314		284			598
	5. DEVELOPMENTAL COSTS (Add totals in column f)						111,928
OPERATIONAL COSTS	6. Data Collection	702					702
	7. Data Processing			178			178
	8. Data Transmission			5		24	29
	9. OPERATIONAL COSTS FOR ONE REPORT (Add totals in column f)						909
	10. ANNUAL OPERATIONAL COSTS (Cost for one report multiplied by frequency per year)						1,818
USER COSTS	11. Refining, Interpreting, and Analyzing Information Received	657		142			799
	12. Reading, Reviewing, Discussing, and Documenting Information Presented	714				10	724
	13. USER COSTS FOR ONE REPORT (Add totals in column f)						1,523
	14. ANNUAL USER COSTS (Cost for one report multiplied by frequency per year)						3,046

NOTE: (Estimates of reporting costs should be prepared in accordance with GUIDE TO ESTIMATING REPORTING COSTS which is issued by GSA/NARS/NR)

50101-101
GPO : 1974 O-540-459

OPTIONAL FORM 101
FEBRUARY 1974
GENERAL SERVICES ADMINISTRATION

FIGURE 42-1. EXAMPLE OF SUMMARY WORKSHEET FOR ESTIMATING REPORTING COSTS

Example for Government-Required Report[1]

Cost Element		Personnel[2]	Equipment	Other	Total
Developmental					
Specification:					
20 hr @ (GS-13)	$41.01	= $820			
10 hr @ (GS-5)	15.72	= 157			
10 hr @ (GS-10)	26.23	= 262			
1 hr @ (GS-15)	56.88	= 57			
Subtotal		$1,296			$ 1,296
Analysis:					
10 hr @ (GS-13)	$41.01	= 410			410
Design:					
Program Management:					
10 hr @ (GS-14)	$48.41	=			484
Contractor R&D Effort:					
2 staff-years @	$110,400	=		$220,800	220,800
Programing:					
10 hr @ (GS-12)	$34.54	= 345			
Review:					
2 hr @ (GS-13)	$41.01	= 82			
Coordinations:					
1 hr @ (GS-14)	$48.41	= 48			
Clerical:					
10 hr @ (GS-3)	$12.52	= 125			600
Mailing Cost: 12 Sets					
X 2 reports @	$2.75	=		66	66
Subtotal		$2,790	0	$220,866	$223,656

[1]Example costs are presented above. To obtain current costs, refer to tables 23-2, 24-1, 42-1, and 42-2, other appropriate chapters, and existing contract prices for material, equipment, and contractual services.

[2]Includes retirement, hospital, and insurance.

#	Cost Element			Personnel	Equipment	Other	Total
	Installation:						
	Prepare Instl.: 20 hr @ (GS-12)	$34.54	=	$ 691			
	Clerical: 2 hr @ (GS-3)	$12.52	=	25			
	Test Run 4 hr @ $171		=		$684		
	Subtotal			716	684	0	$ 1,400
	Total Developmental Cost			$3,506	$684	$220,866	$225,056
	Operational						
	Data Collection:						
	Feeder Reports: (manual processing) 8 regions X 3 hr @ (GS-6) $17.53		=	$421			
	8 regions X 1 hr @ (GS-6) $17.53		=	140			
	Review (area and hq.): 3 areas X 3 hr @ (GS-6) $17.53		=	158			
	20 hr @ (GS-9) $23.82		=	476			
	Subtotal			$1,195	0	0	$1,195
	Data Processing:						
	3 areas X .5 hr each + hq. 1 hr = 2.5 hr X $171		=		$1,539		$1,539
	Data Transmission:						
	Xerox: (50 pages X 2 copies) = 100 X $.05		=		$5		
	10 Messages (AUTODIN) X $1.41					$14	
	Mailing: 2 (reports) X $2.75		=			6	
	Subtotal			0	$5	$20	$25

#	Cost Element	Personnel	Equipment	Other	Total
	Operational Cost for One Report:	$1,195	$1,544	$20	$2,759
	Annual Operating Cost: 2 (semiannual reports) X $2,759 =				$5,518
	User				
	Refining, Interpreting, and Analyzing:				
	10 hr @ (GS-14) $48.41	= $480			
	10 hr @ (GS-13) $41.01	= 410			
	20 hr @ (GS-9) $23.82	= 476			
	ADP: 2 hr X $171.00	=	$342		
	10 hr @ (GS-3) $15.72	= 157			
	Subtotal	$1,523	$342	0	$1,865
	Reading, Reviewing, Discussing, and Documentation:				
	20 hr @ (GS-13) $41.01	= 820			
	10 hr @ (GS-14) $48.41	= 484			
	2 hr @ (GS-15) $56.88	= 114			
	1 hr @ (GM-15) $56.88	= 57			
	1 hr @ (GS-12) $34.54	= 35			
	5 hr @ (GS-5) $15.72	= 79			
	Storage (unclassified) 2 X $5.10	=		$10	
	Subtotal	$1,589	0	$10	$1,599
	User Cost for One Report:	$3,112	$342	$10	$3,464
	Annual User Cost: 2 (semiannual report) x $3,464				$6,928

5. Derivation of Factors for Table 42-3. Factors for manual search and duplication are from DCAI 210-225-1. Other cost factors are found elsewhere herein, as referenced in table 42-3.

6. Use of Table 42-3. Only direct costs are charged for FOIA requests. Retirement, leave and holiday, and overhead costs should not be included in the charges. Search fees are to be based on time actually spent. Establishment of a minimum fee is not allowed, and when direct costs for a single FOIA request total less than $30, the fee should be waived in most cases (see DCAI 210-225-1). Table 42-3 provides or references factors for use in FOIA requests.

TABLE 42-3. FREEDOM OF INFORMATION FEES

Cost Element	Factor
Manual Search	
Clerical (E-9, GS-8, and below)	$ 8/hour
Executive (O-7, GS-16, and above)	26/hour
Professional (all other)	16/hour
Computer Search	see table 42-1
Transportation	
Records	see table 24-9
Personnel	see table 24-6
Duplication	
Office Copy	0.10/page
Microfiche	0.25/page
Printed Material	0.01/page

Source: DCAI 210-225-1, 19 Dec 80.

INDEX

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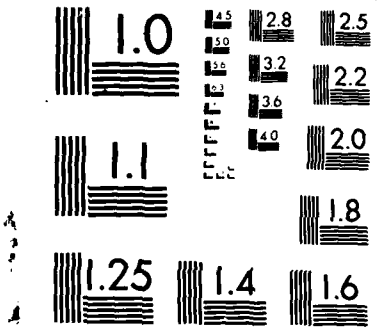
2-83

DTIC

AD-A163 319 DEFENSE COMMUNICATIONS AGENCY COST AND PLANNING FACTORS 3/3
MANUAL CHANGE 2(U) DEFENSE COMMUNICATIONS AGENCY
ARLINGTON VA 23 SEP 85 DCA-CIRC-600-60-1-CH-2

UNCLASSIFIED F/G 17/2 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

SUPPLEMENTARY

INFORMATION

AD-A163319

H690 31 October 1986

TO: DCAC 600-60-1 Distribution

SUBJECT: Personnel Cost Rates for FY 87

Reference: DCAC 600-60-1, DCA Cost and Planning Factors Manual, Change 2, 23 September 1985

The enclosed interim change to DCAC 600-60-1, the Cost and Planning Factors Manual, is primarily to bring economic related tables up-to-date for FY 1987.

1 Enclosure a/s

I. L. SEIDEL
Chief
Cost and Economic Analysis Division

TABLE 23-1. MILITARY PERSONNEL STANDARD RATES

RANK	ARMY	NAVY	MARINE CORPS	AIR FORCE	DCS COMPOSITE
O-10	$118,334	$117,889	$119,054	$117,615	
O-9	117,929	119,457	117,169	117,333	
O-8	117,448	120,977	116,669	117,342	
O-7	111,007	111,689	96,809	110,872	
O-6	100,126	99,926	82,207	98,425	99,560
O-5	83,971	83,388	69,059	82,452	83,447
O-4	69,347	70,043	59,097	70,126	69,620
O-3	56,169	59,451	47,675	57,540	56,756
O-2	43,395	46,204	36,410	44,798	43,971
O-1	33,873	36,180	32,948	34,237	34,096
W-4	62,525	66,042	65,200		62,955
W-3	53,613	57,126	51,965		54,004
W-2	44,811	49,771	44,486		45,283
W-1	39,485		40,146		39,486
E-9	55,963	57,277	56,600	54,923	55,688
E-8	46,687	48,604	45,497	46,496	46,713
E-7	39,465	41,652	39,296	40,319	39,838
E-6	33,662	34,731	33,200	34,435	33,957
E-5	28,566	28,727	28,499	28,998	28,709
E-4	23,461	24,234	24,373	24,777	23,916
E-3	20,418	20,522	20,242	20,944	20,589
E-2	19,088	18,515	17,540	19,089	19,059
E-1	17,390	16,052	15,412	16,278	16,970

NOTE: CY 1987 RATES;
PCS AND RETIREMENT ACCRUAL ARE INCLUDED.
RATES FOR O-9 AND O-10 REFLECT LIMIT OF $68,700

SOURCE: MILDEPS; DCA CODE 690, OCT 86

TABLE 23-2. DCA MILITARY LABOR RATES

	ANNUAL RATES		HOURLY RATES		
RANK	PROGRAM, BUDGET, ACC'TING 1	ECON ANALYSIS 2	REPORTS 3	REIMB'S FROM OUTSIDE FED GOV 4	REIMB'S FROM FED AGEN 5
O-6	$99,560	$116,143	$67.65	$57.57	$57.57
O-5	83,447	99,063	56.65	48.24	48.24
O-4	69,620	84,407	47.20	40.23	40.23
O-3	56,756	70,771	38.42	32.78	32.78
O-2	43,971	57,219	29.69	25.38	25.38
O-1	34,096	46,751	22.95	19.66	19.66
W-4	62,955	77,341	42.65	36.37	36.37
W-3	54,004	67,854	36.54	31.19	31.19
W-2	45,283	58,609	30.59	26.14	26.14
W-1	39,486	52,464	26.63	22.78	22.78
E-9	55,688	76,248	37.86	35.77	35.77
E-8	46,713	65,657	31.73	29.99	29.99
E-7	39,838	57,545	27.03	25.56	25.56
E-6	33,957	50,605	23.02	21.77	21.77
E-5	28,709	44,413	19.44	18.39	18.39
E-4	23,916	38,757	16.16	15.30	15.30
E-3	20,589	34,831	13.89	13.15	13.15
E-2	19,059	33,026	12.85	12.17	12.17
E-1	16,970	30,560	11.42	10.82	10.82

NOTE: CY 1987 RATES.

SOURCE: TABLE 23-1; DCA CODE 690, OCT 86

TABLE 23-3. DCA MILITARY LABOR RATES - MAJOR

	ANNUAL RATES		HOURLY RATES		
COST ELEMENT	PROGRAM, BUDGET, ACC'TING	ECON ANALYSIS	REPORTS	REIMB'S FROM OUTSIDE FED GOV	REIMB'S FROM FED AGEN
	1	2	3	4	5
STANDRD RATE	$69,620	$69,620	$69,620	$69,620	$69,620
MEDICAL		383			
INSTL SUPT		4,863			
TRAINING		4,209			
TDY		1,300			
PERS SUPT		4,031		4,031	4,031
OVERHEAD			16,798		
LV/HOLIDAY			12,099	10,311	10,311
ANNUAL RATE	$69,620	$84,407			
HOURLY RATE			$47.20	$40.23	$40.23

NOTE: CY 1987 RATES.

SOURCE: DCA CODE 690, OCT 86

TABLE 24-1. DCA CIVILIAN LABOR RATES

	ANNUAL RATES		HOURLY RATES		
GRADE	PROGRAM, BUDGET, ACC'TING 1	ECON ANALYSIS 2	REPORTS 3	REIMB'S FROM OUTSIDE FED GOV 4	REIMB'S FROM FED AGEN 5
SES	$80,185	$101,838			
15	69,157	88,078	$60.91	$48.73	$39.10
14	58,862	75,232	51.83	41.46	33.28
13	49,885	64,031	43.91	35.13	28.21
12	42,026	54,224	36.98	29.58	23.76
11	35,077	45,569	30.86	24.69	19.83
10	31,924	41,644	28.09	22.47	18.05
9	28,992	37,994	25.51	20.41	16.39
8	26,248	34,578	23.10	18.48	14.84
7	23,698	31,403	20.85	16.68	13.40
6	21,328	28,452	18.77	15.01	12.06
5	19,133	25,720	16.83	13.47	10.82
4	17,103	23,193	15.05	12.04	9.67
3	15,233	20,864	13.40	10.72	8.61
2	13,515	18,726	11.89	9.51	7.64
1	12,414	17,355	10.92	8.74	7.02

NOTE: CY 1987 RATES; SES CALCULATED AT $70,800

SOURCE: DCA, CODE 690, OCTOBER 1986

TABLE 24-2. DCA CIVILIAN LABOR RATES - GS-13

	ANNUAL RATES		HOURLY RATES		
COST ELEMENT	PROGRAM, BUDGET, ACC'TING	ECON ANALYSIS	REPORTS	REIMB'S FROM OUTSIDE FED GOV	REIMB'S FROM FED AGEN
	1	2	3	4	5
PAYROLL RATE	$43,891	$43,891	$43,891	$43,891	$43,891
BENEFITS	5,994	5,994	5,994	5,994	5,994
FULL RET INCR		12,246	12,246	12,246	
TRAINING		580			
TDY		1320			
OVERHEAD			15,533		
LV/HOLIDAY			13,979	11,184	8,979
ANNUAL RATE	$49,885	$64,031			
HOURLY RATE			$43.91	$35.13	$28.21

NOTE: CY 1987 RATES. SEE PARAGRAPH 1a(4)(d) FOR COSTS THAT ARE POTENTIALLY ADDITIVE FOR ECONOMIC ANALYSES.

SOURCE: DCA, CODE 690, OCTOBER 1986

CHAPTER 35. INTERNATIONAL MONETARY RATES OF EXCHANGE

1. General. This chapter contains monetary exchange rates for budgetary and planning purposes. Actual rates are subject to day-to-day fluctuations; however, OSD(C) has directed that rates contained herein be used for the purposes stated. Paying offices will record variations from the designated rates by entering the value of the variations in special accounts established for this purpose.

2. Use of Table. Table 35-1 lists the exchange factors by budget year. To determine the (United States) cost of a contract or lease, first obtain the price in the foreign currency and then convert to U.S. dollars.

a. Example 1. The FY 1987 cost of contract is 2,744,100 yen (Japan). The rate of exchange for Japan is 200.55 yen to the U.S. dollar.

2,744,100 yen/200.55 = $13,683

b. Example 2. The FY 1987 cost of a lease is 3,831 British pounds sterling (United Kingdom). The rate of exchange for the United Kingdom is 0.69 pounds to the U.S. dollar.

3,831 pounds/0.69 = $5,552

c. Example 3. These factors can also be used to convert from dollars to local currency. If the amount to be received is $1,000 FY 1987 dollars with payment to be made in Deutsch marks, the calculation is:

$1,000 x 2.46 = 2,460 DM

TABLE 35-1. FOREIGN CURRENCY EXCHANGE RATES

Country	Monetary Unit	Foreign Currency Per U.S. Dollar FY 1987, 1988, and 1989 Budget Estimates
Belgium	Franc	50.36
Canada	Dollar	1.40
Denmark	Krone	8.97
Fed Rep of Germany	Mark	2.46
France	Franc	7.54
Greece	Drachma	150.80
Italy	Lira	1,678.00
Japan	Yen	200.55
Netherlands	Guilder	2.77
Norway	Krone	7.58
Portugal	Escudo	158.00
Spain	Peseta	154.00
Turkey	Lira	569.65
United Kingdom	Pound	0.69

Source: "FY 1987 Revised, FY 1988 and FY 1989 Budget Estimates Guidance," OSD(C) Memorandum, 3 Jul 86.

TABLE 38-1. PRICE LEVEL INDEXES

FISCAL YEAR	PURCHASES				PAY & ALLOW	
	PROC	RDTE	MILCON	O&M	CIV	MIL
1974	40.4	40.4	40.4	38.9	47.6	43.8
1975	46.5	46.5	46.5	47.0	51.6	46.7
1976	50.0	50.0	50.0	50.2	55.9	49.1
1977	54.1	54.1	54.1	54.1	60.9	51.9
1978	58.0	58.0	58.0	58.0	65.5	55.5
1979	63.2	63.2	63.2	63.2	69.5	58.8
1980	69.9	69.9	69.9	69.9	74.2	63.0
1981	77.4	77.4	77.4	77.4	80.6	73.0
1982	83.2	83.2	83.2	83.2	85.2	83.0
1983	86.6	86.6	86.6	86.6	89.2	86.3
1984	89.9	89.9	89.9	89.9	91.9	88.9
1985	93.1	93.1	93.1	93.1	96.9	92.5
1986	96.1	96.1	96.1	96.1	97.7	96.2
1987	100.0	100.0	100.0	100.0	100.0	100.0
1988	103.9	103.9	103.9	103.9	103.2	104.8
1989	107.4	107.4	107.4	107.4	106.5	110.1
1990	110.6	110.6	110.6	110.6	109.9	115.5
1991	113.1	113.1	113.1	113.1	113.5	120.7
1992	116.9	116.9	116.9	116.9	117.1	126.9
1993	120.9	120.9	120.9	120.9	120.9	133.4
1994	125.0	125.0	125.0	125.0	124.8	140.2
1995	129.3	129.3	129.3	129.3	128.8	147.3
1996	133.7	133.7	133.7	133.7	132.9	154.8
1997	138.2	138.2	138.2	138.2	137.2	162.7
1998	142.9	142.9	142.9	142.9	141.6	171.0
1999	147.7	147.7	147.7	147.7	146.2	179.7
2000	152.8	152.8	152.8	152.8	150.9	188.8
2001	158.0	158.0	158.0	158.0	155.7	198.5
2002	163.3	163.3	163.3	163.3	160.7	208.6
2003	168.9	168.9	168.9	168.9	165.9	219.2
2004	174.6	174.6	174.6	174.6	171.2	230.4
2005	180.5	180.5	180.5	180.5	176.8	242.1
2006	186.7	186.7	186.7	186.7	182.4	254.5
2007	193.0	193.0	193.0	193.0	188.3	267.4
2008	199.6	199.6	199.6	199.6	194.4	281.0
2009	206.4	206.4	206.4	206.4	200.6	295.4
2010	213.4	213.4	213.4	213.4	207.1	310.4
RATE	3.4	3.4	3.4	3.4	3.2	5.1

NOTES: BASE - FISCAL YEAR= 1987
PROCUREMENT, RDT&E, MILCON, AND O&M INDEXES EXCLUDE PAY AND FUEL.

SOURCE: "DOD DEFLATORS (OUTLAYS)," 2-3-86 AND OASD(C) MEMO "PRICE ESCALATION INDICES," 9-9-86

TABLE 38-2. PROGRAM EXPENDITURE RATES

FISCAL YEAR	APPROPRIATION				
	PROC	RDTE	MIL CONSTR	O&M	MIL & CIV P & A
FIRST	0.31	0.48	0.07	0.73	1.00
SECOND	0.37	0.43	0.23	0.24	
THIRD	0.22	0.06	0.31	0.03	
FOURTH	0.07	0.02	0.20		
FIFTH	0.02		0.10		
SIXTH			0.06		
SEVENTH			0.03		

SOURCE: OUTLAY RATES - DEFENSE AGENCIES, POM PREPARATION INSTRUCTIONS OASD (PA&E), 1-31-86

TABLE 38-3. WEIGHTED (TOA) PRICE LEVEL INDEXES

FISCAL YEAR	PURCHASES				PAY & ALLOW	
	PROC	RDTE	MILCON	O&M	CIV	MIL
1974	46.2	44.0	51.6	41.2	47.6	43.8
1975	50.7	48.8	56.0	48.0	51.6	46.7
1976	54.7	52.6	60.7	51.4	55.9	49.1
1977	59.2	56.7	66.1	55.3	60.9	51.9
1978	64.6	61.5	72.0	59.6	65.5	55.5
1979	70.8	67.5	78.0	65.2	69.5	58.8
1980	77.3	74.4	83.3	72.1	74.2	63.0
1981	82.8	80.8	87.5	79.0	80.6	73.0
1982	86.9	85.3	91.0	84.2	85.2	83.0
1983	90.2	88.6	94.3	87.5	89.2	86.3
1984	93.5	91.9	97.7	90.8	91.9	88.9
1985	96.8	95.1	101.2	94.0	96.9	92.5
1986	100.4	98.5	104.8	97.2	97.7	96.2
1987	104.2	102.4	108.3	101.2	100.0	100.0
1988	107.6	106.1	111.6	104.9	103.2	104.8
1989	110.8	109.4	114.9	108.3	106.5	110.1
1990	114.0	112.3	118.5	111.3	109.9	115.5
1991	117.5	115.5	122.4	114.2	113.5	120.7
1992	121.5	119.5	126.6	118.1	117.1	126.9
1993	125.6	123.5	130.9	122.1	120.9	133.4
1994	129.9	127.7	135.3	126.3	124.8	140.2
1995	134.3	132.0	139.9	130.6	128.8	147.3
1996	138.8	136.5	144.7	135.0	132.9	154.8
1997	143.6	141.2	149.6	139.6	137.2	162.7
1998	148.4	146.0	154.7	144.3	141.6	171.0
1999	153.5	150.9	159.9	149.2	146.2	179.7
2000	158.7	156.1	165.4	154.3	150.9	188.8
2001	164.1	161.4	171.0	159.6	155.7	198.5
2002	169.7	166.8	176.8	165.0	160.7	208.6
2003	175.4	172.5	182.8	170.6	165.9	219.2
2004	181.4	178.4	189.0	176.4	171.2	230.4
2005	187.5	184.4	195.4	182.4	176.8	242.1
2006	193.9	190.7	202.1	188.6	182.4	254.5
2007	200.5	197.2	209.0	195.0	188.3	267.4
2008	207.3	203.9	216.1	201.6	194.4	281.0
2009	214.4	210.8	223.4	208.5	200.6	295.4
2010	221.6	218.0	231.0	215.8	207.1	310.4

NOTE: BASE - FISCAL YEAR = 1987

SOURCE: TABLES 38-1 AND 38-2; DCA CODE 690, 10-86

END

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